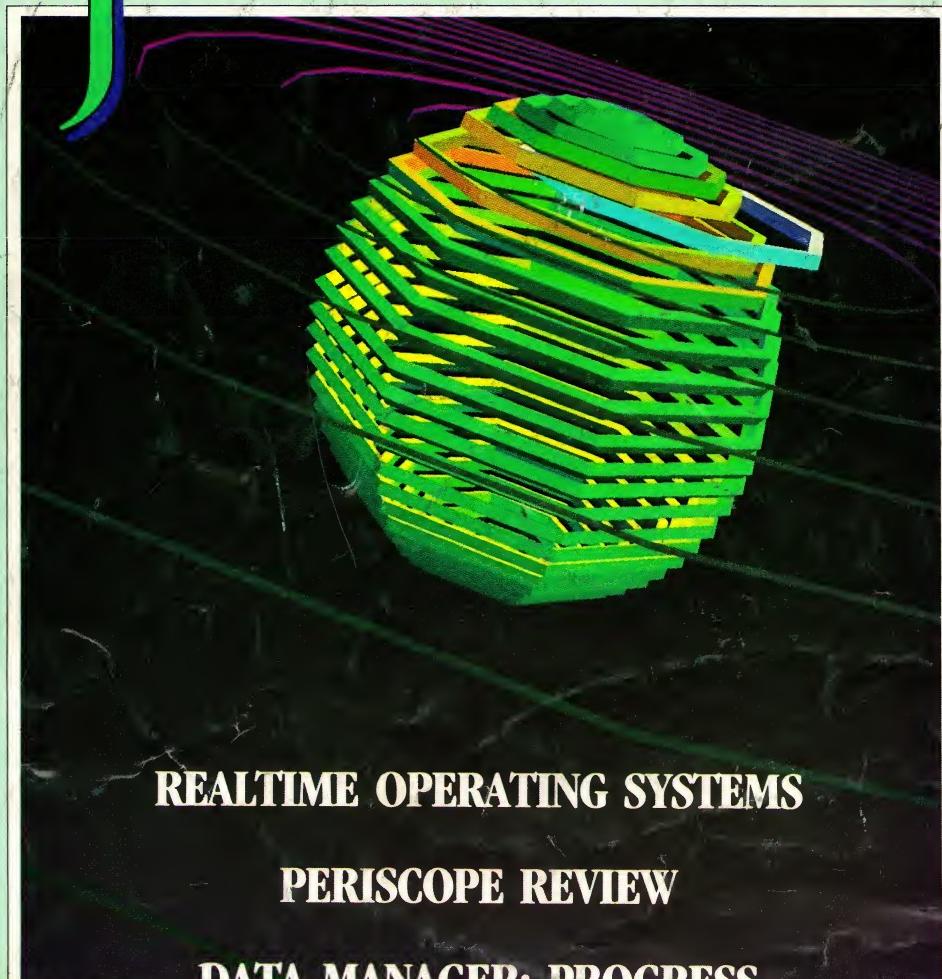


MARCH 1986

VOL. 4, No. 3 \$3.95

FOR IBM PERSONAL COMPUTER USERS

TECH JOURNAL

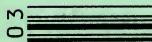


REALTIME OPERATING SYSTEMS

PERISCOPE REVIEW

DATA MANAGER: PROGRESS

EDITORS FOR THE PC



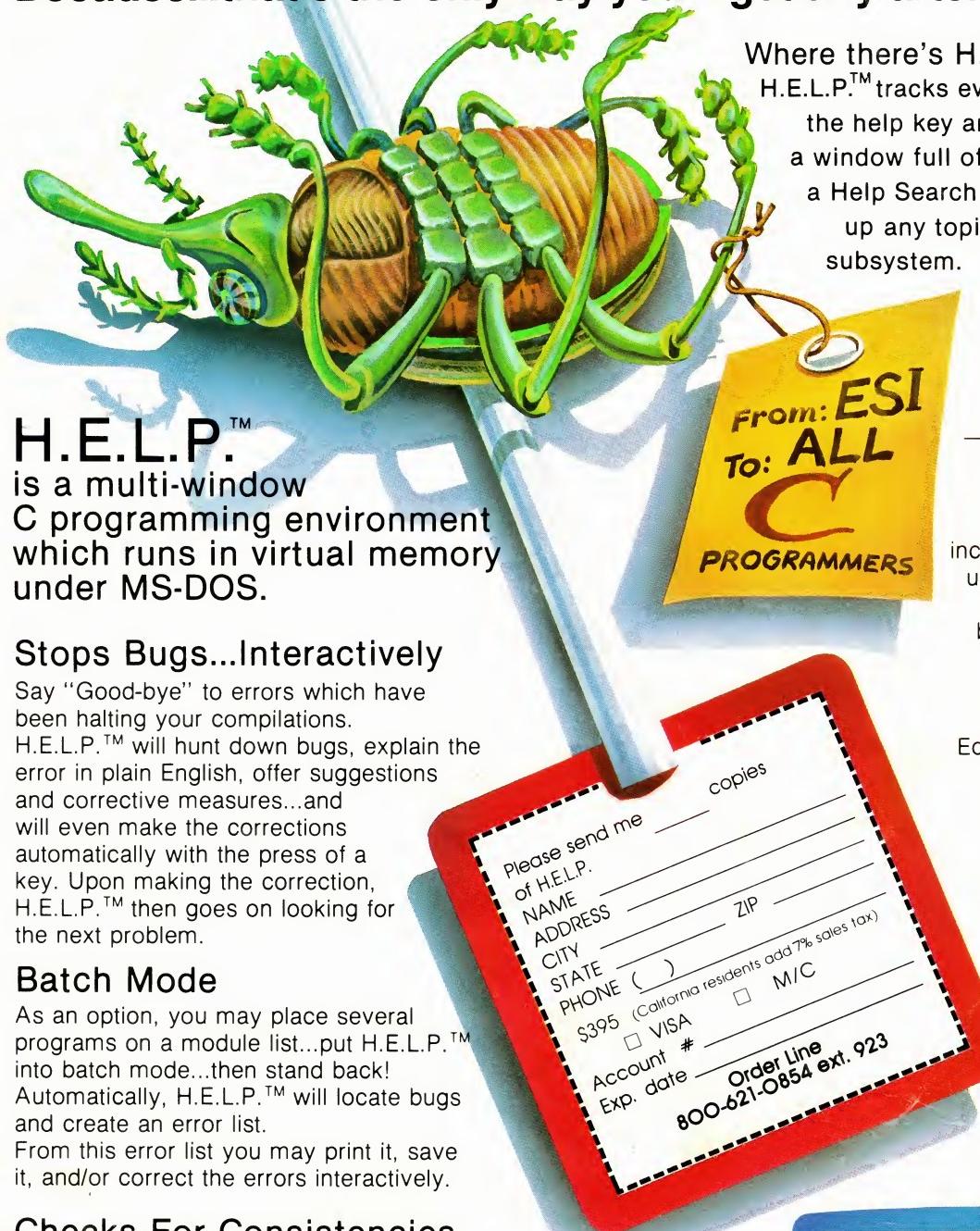
CA 94086

03*H

O

We'll Send You a Bug ...

Because...that's the only way you'll get any after using H.E.L.P.™



H.E.L.P.™
is a multi-window
C programming environment
which runs in virtual memory
under MS-DOS.

Stops Bugs...Interactively

Say "Good-bye" to errors which have been halting your compilations.

H.E.L.P.™ will hunt down bugs, explain the error in plain English, offer suggestions and corrective measures...and will even make the corrections automatically with the press of a key. Upon making the correction, H.E.L.P.™ then goes on looking for the next problem.

Batch Mode

As an option, you may place several programs on a module list...put H.E.L.P.™ into batch mode...then stand back!

Automatically, H.E.L.P.™ will locate bugs and create an error list.

From this error list you may print it, save it, and/or correct the errors interactively.

Checks For Consistencies

H.E.L.P.™ will examine your code across modules to check the usage of externals as well as functions and parameter usage. This means your modules will pass through the linker with far fewer errors.

MS DOS is a registered trademark of MicroSoft, Inc.
H.E.L.P. is a trademark of Everest Solutions, Inc.

Order Line 800-621-0854 ext 923

EVEREST Everest Solutions

3350 Scott Blvd. Bldg 58
Santa Clara, CA 95051
(408) 986-8977

Where there's H.E.L.P.™ there's help!!
H.E.L.P.™ tracks every step you make...press the help key and you are presented with a window full of assistance. There's even a Help Search Key so that you can look up any topic or string within the help subsystem.

H.E.L.P.™ will positively find every syntax and semantic error which would have caused your code to fail at compilation.

Have It Your Way

Navigate through all the incredible features of H.E.L.P.™ using POP-UP menus...or you may by-pass the menus by binding commands to keys... (user definable).

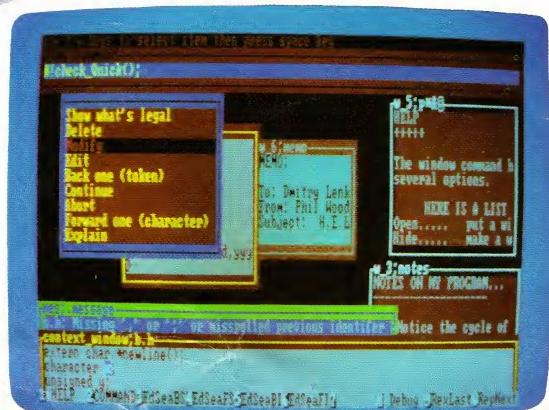
Full-Blown Editor

Edit code in as many windows as you want...there are no limitations!

Move or copy text within a window or to an entirely different window.

Virtual Memory

H.E.L.P.™ uses the power of main frames running in virtual memory... this means you may create a program or work space larger than the actual RAM memory of your system.



H.E.L.P.™ makes your computer feel like a main frame... and increase productivity by 300% and more.

ZIM 2.5 A DBMS REVOLUTION

Have you been looking for perfect data management that you can enjoy on your own terms? Then you've probably already heard of ZIM 2.4 — the most powerful database system available. Until now. Because ZIM 2.5 is here.

ZIM 2.5 is a fourth generation application development tool which makes it possible to expand the capabilities of your micro beyond what you've ever imagined. ZIM mirrors the complexities of the real world by letting you develop as many and as varied applications as you could possibly need.

"ZIM is...a successful migration of mainframe ideas and needs to a micro. (ZIM) proves not only that the job can be done but also that it can be done well. ZIM provides a reference against which current and future data bases can be judged." James Creane, Data Based Advisor/July 1985.

Speed

ZIM breaks the speed limit — between 3 and 50 times faster than industry leaders in sorting and joining files within the data-base. ZIM's internal architecture, and the implementation of its strategy analyzer and priority-driven buffering ability, ensure that data is processed in the most efficient manner possible.

Portability

ZIM is the only database management system with 100% application portability for single-user and multi-user configurations. ZIM is available under PC-DOS, Concurrent PC-DOS, UNIX, XENIX, and QNX. Never again will you be required to re-write your applications for different operating systems environments.

Power

ZIM's high-level language lets you build user commands which implement applications without the necessity and cost of additional programming tools. ZIM's forms facility and extensive report generator permit completely menu-driven applications. Completed compiled, applications use the Runtime System, leading to fast execution, preventing unauthorized access or modifications, and decreasing cost and memory requirements.

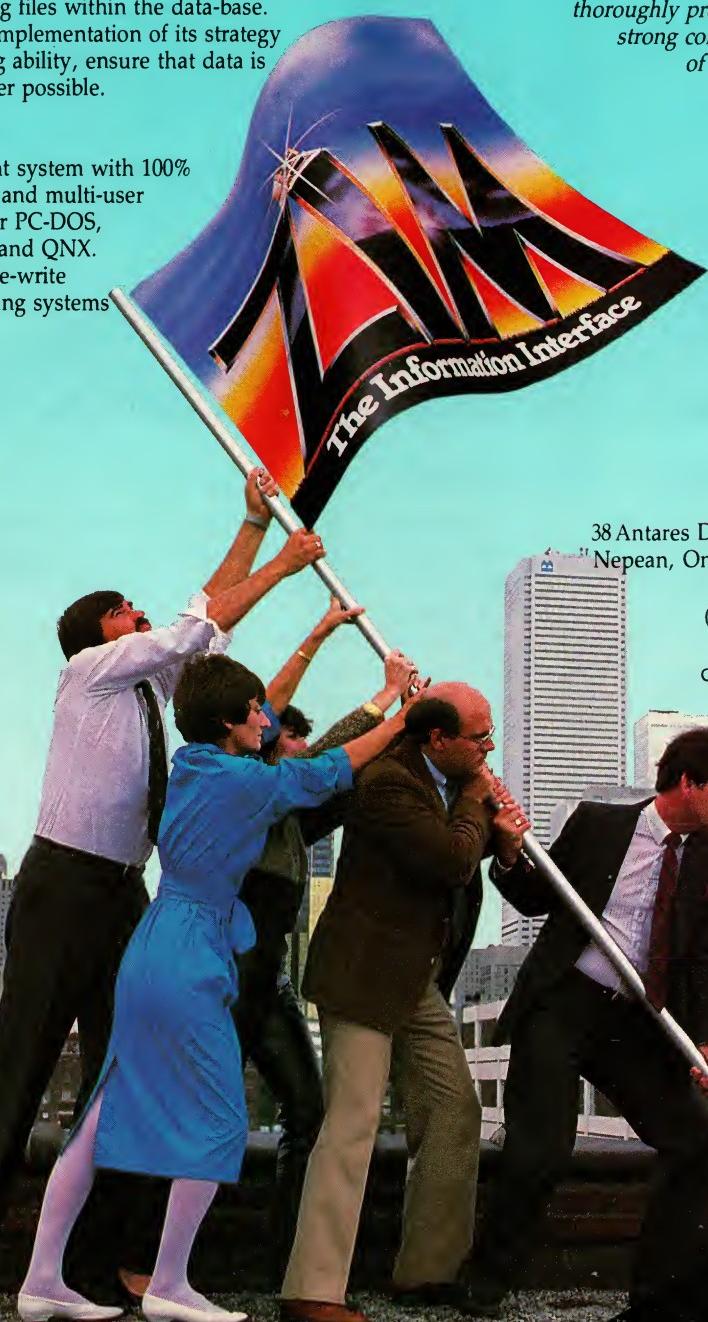
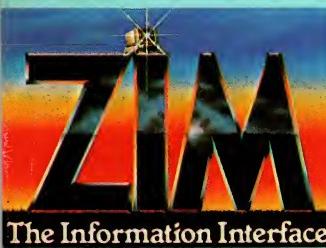
Flexibility

ZIM gives you unprecedented simplicity and flexibility. ZIM commands parallel simple English sentences, making it easy to learn and use. Other features include automatic updates of all indexes, multi-user support, and an extensive range of validation, editing and masking facilities. ZIM's limits are only those of your hardware, operating system and imagination. And with ZIM 2.5, your database is no longer limited to a single hard disk.

"ZIM is (a) well-conceived, soundly-implemented, thoroughly professional system. Its design evidences a strong commitment to consistency and to the goal of natural nonprocedural user interaction."

Richard M. Foard, PC Tech Journal,
October 1985.

ZIM 2.5 — DATA
MANAGEMENT AT
ITS BEST



38 Antares Dr., Suite 1200
Nepean, Ontario, Canada
K2E 7V2
(613) 727-1397

CIRCLE NO. 148 ON READER SERVICE CARD



IN THE U.S. CALL
800-267-9972
TOLL FREE

If you can't share files on your network, you're using the wrong file manager.



Be connected. Btrieve.®

Networks can solve problems. But running a single-user file manager can create new ones: Lost updates. Garbled data. Trashed files.

Btrieve® /N offers *safe* multi-user file management that protects your data when sharing files. And eliminates the need to rewrite your application for networking. Btrieve/N set the file management standard for the industry's most popular LANS: IBM's PC Network, Netware, PC Net and Ether-Series. And now Btrieve/N sets the standard for multi-user systems: XENIX, MultiLink Advanced and others.

Fast. Btrieve/N is fast, too. It's written in assembly language especially for the IBM PC. And based on b-tree file indexing with automatic balancing for access speed that won't degrade as your database grows. With Btrieve/N, your applications always run fast. And users don't waste time waiting.

Automatic file recovery. Btrieve/N provides automatic file recovery after

a system crash, so accidents and power failures don't turn into database disasters. Your Btrieve data always comes back intact.

Fully-relational data management. SoftCraft's entire family of products gives you a complete, fully-relational database management system. Rtrieve™/N adds report writing capabilities for generating the reports you need. Xtrieve™/N speeds users through database queries with interactive, on-screen menus—no command language or special syntax.

For professional programmers. Btrieve/N is the fast, reliable answer for all your application development. In any development language—BASIC, Pascal, COBOL, C, FORTRAN and APL. With multikey access to records. Unlimited records per file. Duplicate, modifiable, and segmented keys.

With Btrieve/N, you can develop better network applications. And solve problems, not create new ones.

NO ROYALTIES

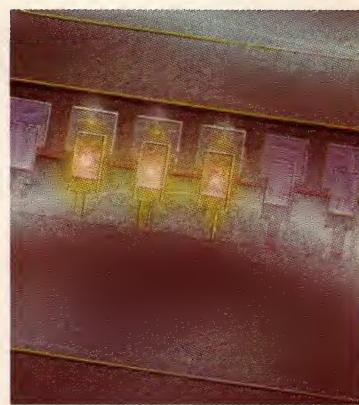
Suggested retail prices: Btrieve, \$245; Btrieve/N, \$595; Xtrieve, \$195; Xtrieve/N, \$395; Rtrieve, \$85; Rtrieve/N, \$175. Requires PC-DOS or MS-DOS 1.X, 2.X, or 3.X.

Btrieve is a registered trademark and Xtrieve and Rtrieve are trademarks of SoftCraft Inc.



SoftCraft Inc.

P.O. Box 9802 #917
Austin, Texas 78766
(512) 346-8380 Telex 358 200



78

113

65

MULTITASKING METHODS / RICHARD M. FOARD

The PC has the ability to handle the concurrent processing necessary for building realtime systems. This first in a series of articles on realtime systems examines two packages that operate a multitasking environment atop DOS.

48

BREAKING OUT WITH PERISCOPE / WARD CHRISTENSEN

Although it lacks some of the power of hardware-assisted debuggers, Periscope, from Data Base Decisions, offers a unique breakout button and strong command set that make it a solid contender among symbolic debuggers—and at a reasonable price.

65

BACKUP UTILITY PERFORMANCE / STEVEN ARMBRUST and TED FORGERON

Before resigning themselves to using the standard DOS BACKUP and RESTORE commands, hard-disk owners who are not quite ready to buy more expensive tape backup units should consider a software solution: utilities for backup to diskette.

78

A CADD SOLUTION / VICTOR E. WRIGHT

CADVANCE, CalComp's reincarnation of CADPLAN, one of the better-known microcomputer-based CAD packages, offers the database management and report generation features that are normally associated with larger CADD systems.

86

IN THE ISPF TRADITION / RUDY S. SPRAYCAR

The power of an IBM mainframe full-screen editor is being passed on to the PC in the form of ISPF emulators. Four such products are reviewed and compared to mainframe ISPF: they are APS/SPF, HCS Editor, micro/SPF, and SPF/PC.

113

A DATA MANAGER FOR TRANSACTION PROCESSING / MARK KARAMAN

The mainframe influence is evident in Data Language Corporation's PROGRESS. Among the features that distinguish it among other microcomputer data managers are transaction processing, crash recovery, and fourth generation language.

142

11

DIRECTIONS

Automatic PCs

15

LETTERS

29
PRODUCT OF
THE MONTH

Prototypes in Motion

30

TECH RELEASES

43

TECH NOTEBOOK

Accelerating 2.1

44

TECH NOTEBOOK

Ensuring Data Integrity

46

TECH NOTEBOOK

Elusive Acquisition

161

PROGRAMMING PRACTICES

*Taking Command in
Turbo Pascal*

179

PRODUCT WATCH

189

LEGAL BRIEF

License to Sell

193

BOOK REVIEWS

Keeping the Family Straight

198

TECH BOOK

204

TECH MART

207

CALENDAR

217

READER SERVICE CARD

PRODUCTIVITY TOOLS

From Opt-Tech Data Processing

NEW
Version

Opt-Tech Sort™

NEW
Version

ALL NEW Version 3.0 features even faster sorting, record selection, output record reformatting, dBASE III files, comma delimited fields, and much more. This high performance sort/merge/record selection utility can be used as a stand-alone program or called as a subroutine from most languages.

Supports unlimited filesizes, multiple input files and fixed or variable length records. Many special file types are supported including Btrieve and dBASE. Up to nine sort control fields (ascending or descending), all common data types supported. Output files can be combinations of full records, keys or pointers, subsets of the input file fields, and literal values.

Written in assembly language for **high performance**. Example: 4,000 128 byte records sorted to give key and pointer in 30 seconds. **\$149.**

On-Line Help™

A comprehensive utility for adding help windows to your programs. It provides efficient utilities and routines for interfacing your programs with the help system routines and help message libraries.

Help windows are displayed in a fraction of a second. You have total control over the contents of the window, its size and its position on the screen, including the display and border colors.

On-Line Help can be interfaced with interpreted Basic and all popular compilers. **\$149.**

Scroll & Recall™

Allows you to conveniently scroll back through data that has gone off the top of your display screen. Up to 27 screens of data can be recalled or written to a disk file (great for documenting systems operations).

Allows you to easily recall and edit your previously entered DOS commands and data lines without re-typing.

Scroll & Recall is very easy to use. It's a resident utility that's always there when you need it! **\$69.**

All programs IBM PC/XT/AT & MS-DOS compatible.

Visa, M/C, AMEX, Check, Money Order, COD or Purchase Orders accepted.

Quantity and Dealer Discounts Available

To order or to receive additional information write or call:

Opt-Tech Data Processing

P.O. Box 678 - Zephyr Cove, NV 89448
(702) 588-3737

TECH JOURNAL

VOL. 4, NO. 3

PUBLISHER: Newton Barrett

EDITOR: Will Fastie

EDITORIAL

MANAGING EDITOR: Marjory Spraycar

EXECUTIVE EDITOR: Julie Anderson

TECHNICAL EDITORS: Jeff Duntemann, Caroline Halliday

ASSOCIATE TECHNICAL EDITOR: Dan Beale

SENIOR COPY EDITOR: Susan Holly

COPY EDITOR: Gail Shaffer

PROOFREADER: Kathleen Peddicord

CONSULTING EDITORS: Thomas V. Hoffmann, Richard M. Foard

CONTRIBUTING EDITORS: Steven Armburst, Don Avault, Michael Covington, Ted Forgeron, Augie Hansen, Ted Mirecki, Max Stul Oppenheimer

ADMINISTRATIVE ASSISTANT: Diana Carey

EDITORIAL ASSISTANT: Carole Autenzio

ART & PRODUCTION

ART DIRECTOR: Ina Saltz

ASSOCIATE ART DIRECTOR: Sharon Reuter

ASSISTANT ART DIRECTOR: Sandra Ray

ART SECRETARY: Sabrina Reynolds

ADVERTISING PRODUCTION MANAGER: Lisa Franey Ducey

EDITORIAL PRODUCTION COORDINATOR: Eve Hinderer

ADVERTISING SALES

ADVERTISING DIRECTOR: Rita Burke

MARKETING COORDINATOR: Julie Henderson

ADVERTISING COORDINATOR: Michele Fischetti

DISTRICT MANAGERS: Rosemarie Caruso, Jan Schultz—East Coast; Lisa Kampfmann—Midwest; Ted Babr, Bill Bush, Phyllis Egan—West Coast

ACCOUNT REPRESENTATIVES: Pat Toohey, Jane Anderson—East Coast; Arlene Braithwaite—Midwest; Pam Sigal, Jane Anderson—West Coast

CIRCULATION

CIRCULATION MANAGER: Charles Mast

CIRCULATION SALES DEVELOPMENT: Daniel Rosensweig

MEDIA MANAGER: Melinda Kendall

ZIFF-DAVIS PUBLISHING COMPANY

PRESIDENT: Kenneth H. Koppel

VICE PRESIDENT, Operations: Baird Davis

VICE PRESIDENT, Creative Services: Herbert Stern

VICE PRESIDENT, Circulation: Alicia Marie Evans

VICE PRESIDENT, Circulation Services: James Ramaley

VICE PRESIDENT, Marketing Services: Ann Pollak Adelman

VICE PRESIDENT, Development: Seth Alpert

VICE PRESIDENT: Hugh Tietjen

MARKETING MANAGER: Ronnie Sonnenberg

BUSINESS MANAGER: Gary A. Gustafson

EDITORIAL DIRECTOR: Ernest F. Baxter

ZIFF COMMUNICATIONS COMPANY

PRESIDENT: Philip B. Korsant; EXECUTIVE VICE PRESIDENT: James D. Dunning, Jr.

SENIOR VICE PRESIDENTS: Philip Sine, Kenneth H. Koppel; VICE PRESIDENTS: Laurence Usdin, Rory Parisi, William L. Phillips, J. Malcolm Morris, Steven C. Feinman; TREASURER: Selwyn Taubman; SECRETARY: Bertram A. Abrams

EDITORIAL OFFICE

PC TECH JOURNAL, The World Trade Center, Suite 211, Baltimore, MD 21202. 301/576-0770. FAX (group 3): 301/576-9603. MCIMail: PCTECH. PCTECHline: 301/576-PCMJ. Telex: 6502565932 MCI.

ADVERTISING OFFICES

(East Coast/Midwest) One Park Ave., New York, NY 10016. 212/503-5185.
(West Coast) 3460 Wilshire Blvd., Los Angeles, CA 90010. 213/387-2100;
11 Davis Drive, Belmont, CA 94002. 415/598-2290.

SUBSCRIPTION INQUIRIES

PC TECH JOURNAL, P.O. Box 2968, Boulder, CO 80321. Subscription service: 800/525-0643, 303/447-9330. Back issues: send \$7/copy (\$8 outside U.S.) to Ziff-Davis Publishing, One Park Ave., 4th floor, New York, NY 10016.

PC TECH JOURNAL (ISSN 0738-0194) is published monthly, \$29.97 for one year, \$52.97 for two years, \$69.97 for three years. Additional postage \$6 for Canada & Foreign by Ziff-Davis Publishing Company, One Park Avenue, New York, NY 10016. Second-Class Postage paid at New York, NY and at additional mailing offices. POSTMASTER: Send address changes or subscription inquiries to P.O. Box 2968, Boulder, CO 80321.

PC TECH JOURNAL is an independent journal, not affiliated in any way with International Business Machines Corporation. IBM is a registered trademark of International Business Machines Corp. Entire contents Copyright © 1986 Ziff-Davis Publishing Company. All rights reserved; reproduction in whole or in part without permission is prohibited. Direct written requests to Jean Lamensdorf, Licensing Manager, Reprints/Rights & Permissions, One Park Avenue, New York, NY 10016.



Periscope Delivers Professional Debugging Power

Enhanced Graphics Adapter Support!

GET YOUR PROGRAMS WORKING FAST

"It works, and works well!! In the first day of use I finished up two weeks of problems!!"

—Peter Loats

Periscope is "Always there with just a push of the button". Whenever something unexpected happens, just press the break-out switch and Presto! Periscope's debugging power is at your command. You can check out the problem right away.

Periscope uses names—symbols—from your program so you don't have to remember addresses. It displays source code and line numbers from high-level languages, too. You save hours of time because you access what you need with familiar names!

Periscope's unique breakpoints force bugs out from where they hide. With over 75 breakpoint options, including the ability to write your own breakpoint tests, you'll find those elusive bugs fast!

MAKE YOUR SOFTWARE RELIABLE

"I can't live without it!! BRIEF, a text editor my company wrote, would not be as stable as it is today without Periscope." —David Nanian

With Periscope's broad range of capabilities, you can thoroughly debug your software, giving it the reliability it needs.

One user says that Periscope is a "superbly engineered product" with "virtually every feature possible!"

Here's a sampling of the features:

- See procedure and variable names PLUS source code and line numbers from high-level languages!
- Symbolic In-line Assembler
- 75+ Breakpoint Options—including breakpoints on reads/writes to memory and I/O ports!
- Traceback—see up to 2,016 previous instructions!
- Optional Windows—change them while debugging!
- Optional On-line Help
- Single/Dual-Monitor Support — great for debugging screen-intensive programs!
- View Text Files
- User Exits—customize Periscope with your own programs!
- 8087/80287 Status
- Display memory in most any format



The break-out switch gives you what one user calls "spontaneity of debugging". Press it anytime to stop the executing program and see what's going on. The switch is so handy you'll want to use it to learn more about your PC!

DEBUG PROGRAMS OTHER DEBUGGERS CAN'T

"Periscope has changed my programming life and is truly unique among PC debuggers . . . [it] enables me to debug keyboard routines, device drivers . . . without errors. Periscope is rock solid." —Doug Roberts

Debug memory-resident and non-DOS programs, device-drivers, keyboard handlers, and interrupt-driven programs. Recover when your system hangs or your keyboard locks up. Safely check out what's going on in your system anytime. Debug when DOS is not working, debug DOS.

If your bugs can be found with a software debugger, Periscope can track them down! (We've heard that a competitor uses Periscope to debug his debugger.)

GET THE BEST VALUE!

"[Periscope is] the best value in development tools currently on the market." —Jeff Garbers

Time and again users tell us Periscope is underpriced. They tell us it pays for itself in a matter of hours after they begin using it. This means no professional software developer can afford NOT to try it!

Periscope I: Board, Switch, Software, Manual, Reference Card . . . Just \$295

Periscope II: Switch, Software, Manual, Reference Card . . . Only \$145

HOW TO DECIDE BETWEEN PERISCOPE I & PERISCOPE II

MEMORY BOARD

The key difference between Periscope I and Periscope II is the 'Submarine' board included with the Periscope I package. When you install Periscope I, crucial debugger software loads into the board's memory, which is then write-protected. You don't have to worry about a runaway program destroying it! Periscope II loads into low memory.

BREAK-OUT SWITCH

The break-out switch included with either model of Periscope enables you to debug anytime, even if your system is hung. The Periscope II switch taps into an already-in-use slot, so you don't need a spare slot to install it. The Periscope I switch plugs into the back of the 'Submarine' board, which requires a slot.

WHICH MODEL DO YOU NEED?

If your program writes to memory below itself, you need Periscope I's protected memory to make sure crucial debugger software isn't overwritten. Other than the protected memory, Periscope I and Periscope II are functionally the same debugger!

If you're not sure which model you need, call for details on our trade-up policy. You can buy Periscope II, then trade it in for Periscope I later if you decide you need the protected memory.

Periscope requires: An IBM PC, XT, AT or close compatible; DOS 2.0 or later; 128K RAM; one Disk Drive; and an 80-column Monitor

Don't wait, order YOUR Periscope today!

For Immediate Shipment Or More Information, Call Toll-Free

800-722-7006

30-Day Money-Back Guarantee!

Shipping-UPS ground \$2.50. Air Mail \$8 U.S./Canada, \$24 elsewhere. We accept PO's and COD's in the U.S.

Get Your Programs Up and Running;

UP PERISCOPE!

Data Base Decisions
14 Bonnie Lane
Atlanta, GA 30328
404/256-3860

Achieving a LAN Milestone.

Comprehensive Fault Tolerance for LANs.

In the development of any product or system, only a select few breakthroughs or advancements in technology are significant enough to qualify as milestones. Novell's introduction of System Fault Tolerant (SFT) NetWare is one of those milestones.

What makes SFT NetWare so significant? After all, other fault tolerant systems preceded the development of SFT NetWare. Even more important, who needs fault tolerance?

Data Disaster

Anyone who cannot afford to lose valuable data stored in a computer system needs fault protection. Whether for more traditional mini and mainframe systems or the office automation newcomer, local area networks, protecting against loss of data is a number one priority.

As the number of LAN systems being used to share information in business and industry continues to rapidly increase, the importance of LAN fault tolerance grows. Because as more and more data is stored and shared in a LAN system, the specter of a major data disaster looms larger and larger. And the need to avert such a disaster becomes critical.

While the distributed processing environment of personal computer

LANs provides users with many inherent fault tolerant features, failure can still occur. By greatly reducing the possibility of failure

These two important SFT NetWare characteristics effectively reduce the cost of SFT NetWare to a mere fraction of the cost of other fault tolerant systems. Instead of having to pay for a complete, new proprietary system to get fault protection, in most cases LAN users can now simply add fault tolerance capabilities to their existing LAN systems.

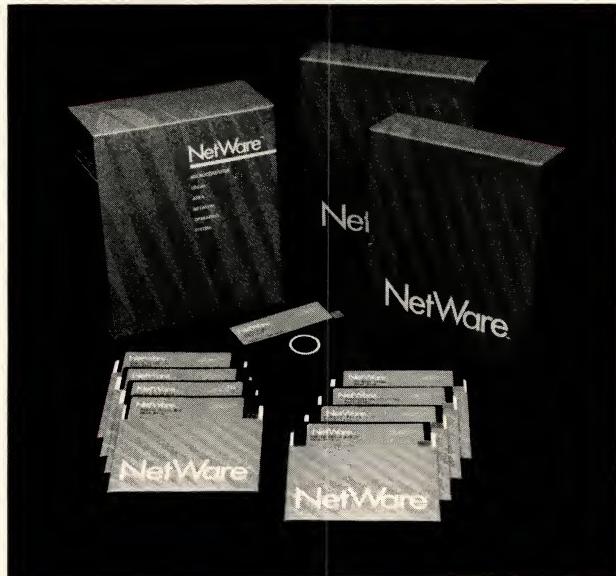
And three varying levels of SFT NetWare allow users to tailor their fault tolerant LAN systems to their specific needs and budgets.

SFT NetWare Level I

Level I provides basic directory and data fault prevention for LAN systems at a minimal startup cost.

Through several specific functions like redundant directory structures, read-after-write verifications, and error detection and correction, SFT NetWare Level I protects and preserves data in case of disk media failure.

A particularly innovative function of Level I is Hot Fix. If a faulty area of the disk is encountered during the read-after-write verification, it is marked as "bad" and listed in the bad block table. The data is then relocated to a known good area without affecting the normal operation of the workstation and server interchange of information.



and providing recovery capabilities, SFT NetWare represents a technological leap in fault protection for LANs. The result of that leap is higher system dependability to accompany the high degree of system flexibility and performance already provided by NetWare-supported local area networks.

Affordability

To make fault tolerance affordable for all LAN users, Novell designed SFT NetWare to utilize off-the-shelf components. In addition, the company wrote SFT NetWare to support 25 major LAN hardware systems.

LAN REPORT 3

SFT NetWare Level II

While the Level I Fault Tolerant System is designed to prevent basic directory and data faults, Level II provides an additional measure of safety through mirroring and duplication of all data. At this level, fault tolerant data storage for the LAN is accomplished either by duplicate storage units on a single controller (mirroring), or by doubled components, including controllers, drives and power supplies (duplexing).

Having duplicate drives, controllers and channels allows "split seeks" to occur on disk reads. The server examines each read request and determines which drive can respond to service the request most quickly. When two or more read requests are presented to the server, they split and occur simultaneously, effectively doubling the system read performance.

SFT NetWare Level III

Level III combines all of the LAN fault tolerant functions of Levels I and II with duplexed file server operation. Two file servers are interconnected using high-speed bus transfer hardware.

If one server fails, the other server automatically takes over network operation. When the failed server is repaired, it resumes its normal network functions. The entire sequence is completed without downtime or loss of data, and is totally transparent to the user and to the application software running on the workstation.

Transaction Tracking System

A major feature of SFT NetWare Levels II and III is the Transaction Tracking System (TTS). TTS ensures that the LAN system views data-

base changes as a single unit of work (a transaction) which will be either wholly completed or wholly backed out.

If a system failure occurs during a transaction, TTS rolls back all database changes made by the transaction, returning the database to its previous point of consistency. Only the failed transaction is lost, leaving the database in its original form (before the transaction was begun).

During normal operation, TTS records periodic "snapshots" of

future of local area networking is most significant. Just as the file server revolutionized the industry and set a standard of LAN performance, System Fault Tolerant NetWare is setting a new standard of LAN reliability.

With that reliability comes all the functionality of NetWare LAN Operating System software. Advantages like unsurpassed speed, multilevel security, and over 2,000 available applications. Plus DOS 3.1 compatibility, allowing NetWare to run any applications written for the IBM Networks.

And because SFT NetWare runs on 25 major LAN hardware systems and utilizes off-the-shelf components, an affordable system of fault tolerant data protection is available right now for the majority of LAN system users.

Although no LAN system can guarantee against any failure, SFT NetWare makes enormous strides in reducing the possibility of failure. This major milestone in LAN technology means greater safety of LAN system data and improved efficiency in LAN operation, for surprisingly little cost.

For more information, order the SFT NetWare Technical Description by writing or calling:

its database files, as well as an audit trail of updates made since the most recent snapshot. In the event of a catastrophic system failure, TTS performs a rollforward recovery, restoring data to the point of the last snapshot, then applying the audit trail to reconstruct remaining files from the archive copies.

With TTS functioning, virtually any real-time application—such as spread sheets, accounting systems, database managers—can be implemented on the LAN system with disaster prevention.

Summary

The impact of SFT NetWare on the

Novell, Inc.
748 North 1340 West
Orem, Utah 84057
(801) 226-8202

 NOVELL

CIRCLE NO. 166 ON READER SERVICE CARD

It's amazing what you can reveal when you strip.

Introducing a shape that's about to turn on an entire industry.

The Softstrip™ data strip. From Cauzin.

This new technology allows text, graphics, and data to be encoded on a strip of paper, then easily entered into your computer using a scanning device called the Cauzin Softstrip™ System Reader.

Creating a simple, reliable and cost efficient way to distribute and retrieve information.

Softstrip data strips, like those you see here, can contain anything that can be put on magnetic disks.

Facts. Figures. Software programs.

Video games. Product demonstrations.

Sheet music.



The Cauzin Softstrip System Reader is now compatible with the IBM PC, Apple II and Macintosh.

A single strip can hold up to 5500 bytes of encoded data.

It can stand up to wrinkles, scratches, ink marks, even coffee stains.

And it can be entered into your computer with a higher degree of reliability than most magnetic media.

Simply by plugging the Cauzin Reader into your serial or cassette port and placing it over the strip.

The reader scans the strip, converts it to computer code, and feeds it into any standard communication interface.

Because strips are so easy to generate, most of your favorite magazines and books will soon be using them in addition to long lists of program code.

And you'll be able to enter programs without typing a single line.

There is also software for you to generate your own strips. Letting you send everything from correspondence to business information using our new technology.

Find out how much you can reveal by stripping. Just take this ad to your computer dealer for a demonstration of the Cauzin Softstrip System Reader.

Or for more information and the name of the dealer nearest you, call Cauzin at 1-800-533-7323. In Connecticut, call 573-0150.

SoftstripTM
COMPUTER READABLE PRINT

Cauzin Systems, Inc.
835 South Main St., Waterbury, CT 06706

CIRCLE NO. 156 ON READER SERVICE CARD

Apple® and Macintosh® are registered trademarks of Apple Computer Inc., Apple® is a registered trademark of Apple Records, Inc., Softstrip® and the Softstrip® System Reader are trademarks of Cauzin Systems, Inc., IBM® is a registered trademark of IBM, Inc.

A DIFFERENT LOOK AT SETS

The Cauzin Softstrip™ data strip allows you to look at data in a whole new light. For instance, the data strips on the right contain the program called SETS which appears on page 108 of PC TECH JOURNAL February 1986. SETS is a utility you can use with Assembly Language to increase the number of features you have at your command. To the Assembly enthusiast, SETS is similar to the Macros Lotus users enjoy. Read the strips into your computer, the files are saved to your data disk.

Refer to the article on page 108 in PC TECH JOURNAL, February, 1986 for a complete review and operating instructions.

Reprinted with permission of PC TECH JOURNAL, a publication of Ziff-Davis Publishing Company.

©1986 Ziff-Davis Publishing Company
Lotus is a trademark of Lotus Development Corporation

1

2

3

4

5

Softstrip
DATA READER

ATRON BUGBUSTERS GREASE BORLAND LIGHTNING

"If I were starting a software company again, from scratch, Atron's AT PROBE™ would be among my very first investments. Without Atron's hardware-assisted, software debugging technology, the flash of Turbo Lightning™ would be a light-year away."

Philippe Kahn, President, Borland

HOW BORLAND DOES SO MUCH, SO WELL, SO FAST

We asked Borland International president Philippe Kahn to share his secrets for rapidly taking a good idea and turning it into rock-solid reality. How does the Borland team do so much, so well, so fast?

He begins, "I remember when Atron used the June 24, 1985 *Wall Street Journal* chart of top-selling software in an ad." [Note: At that time, seven of the top ten software packages were created by Atron customers; it's now nine out of ten.] "SideKick was number four, and I let Atron quote me in saying that there wouldn't have been a SideKick without Atron's hardware-assisted debuggers.

"You might say lightning has literally struck again. Turbo Lightning made number four on

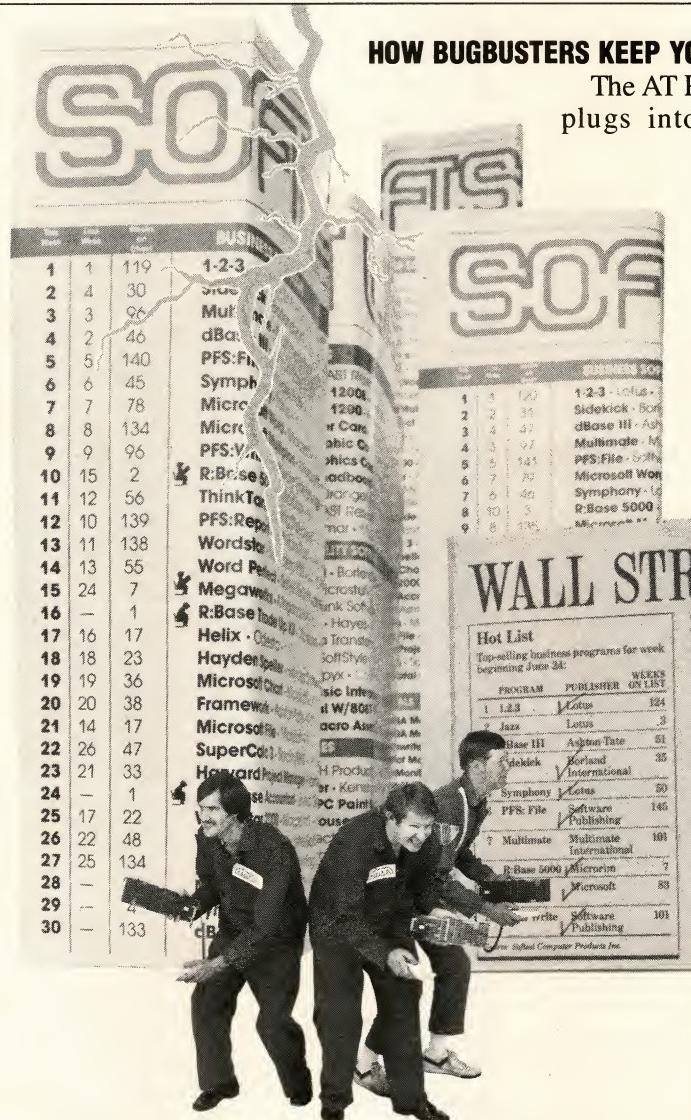
SoftSel's Hotlist within weeks of its introduction! And again, I say we couldn't have done it without Atron debugging technology.

"Cleverly written code is, by definition tight, recursive, and terribly complex," he continues. "Without the ability to externally track the execution of this code, competent debugging becomes very nearly impossible."

Concludes Philippe, "And after Turbo Lightning was solid and reliable, Atron tuning software turned our Probes into performance analyzers. How do you think we greased our lightning?"

Philippe, along with a couple million or so of your satisfied customers, we say congratulations on yet another best-selling product. We can't wait to see what awesomely useful technology will come shooting out of Borland International next.

Copyright © 1985 by Atron Corp. PC PROBE™ and AT PROBE™ Atron. SideKick™ and Turbo Lightning™ Borland International, Inc., Adv. by TRBA, 408/258-2708.



HOW BUGBUSTERS KEEP YOU FROM GETTING SLIMED

The AT PROBE is a circuit board that plugs into your PC/AT. It has an umbilical which plugs into the 80287 socket and monitors all 80286 activity.

Since AT PROBE can trace program execution in real time, and display the last 2048 memory cycles in symbolic or source-code form, you can easily answer the questions: "How did I get here?" and "What are those silly interrupts doing?"

It can solve *spooky* debugging problems. Like finding where your program overwrites memory or I/O - impossible with software debuggers.

You can even do source-level debugging in your favorite language, like C, Pascal or assembler. And after your application is debugged, the AT PROBE's performance measurement software can isolate performance bottlenecks.

Finally, the AT PROBE has its own 1-MByte of memory. Hidden and write-protected. How else could you develop that really large program, where the symbol table would otherwise take up most of memory.

LOOK AT IT THIS WAY.

History shows that non-Atron customers don't stand a very good chance of making the Top Ten list. Lightning *really does* have a way of striking twice!

The PC PROBE™ is \$1595 and the AT PROBE is \$2495. So call Atron today. You can be busting some really scary bugs tomorrow. And maybe, just like Borland, you can also bust some records.

Atron
THE DEBUGGER COMPANY

20665 Fourth Street • Saratoga, CA 95070 • 408/741-5900

CIRCLE NO. 203 ON READER SERVICE CARD

Automatic PCs

IBM's commitment to automated production facilities continues.

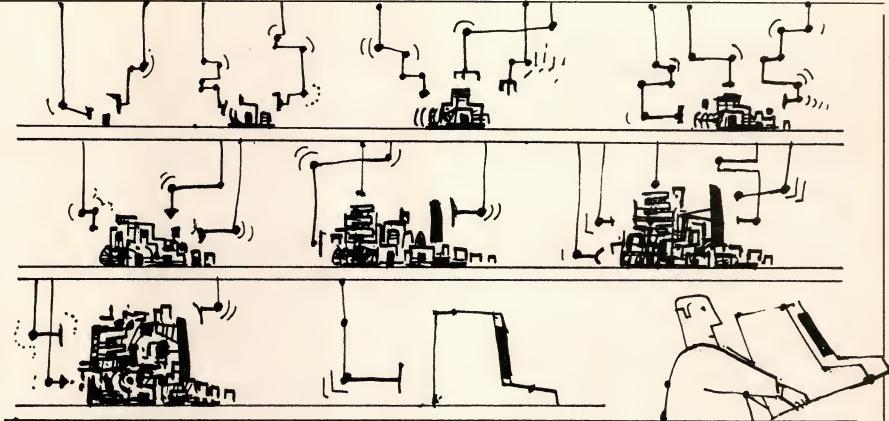
I am a real sucker for manufacturing plant tours, a fact IBM must have on file about me. During *PC Tech Journal's* most recent trip to IBM's Boca Raton facilities, Executive Editor Julie Anderson and I visited a production line that was building PCs and XT's, a visit that proved interesting on several fronts.

Most important was the high level of automation on the assembly line; it is the highest I have seen at IBM to date, more so than the original AT line, which was the most automated at the time of its inception. IBM is quite proud of it, too. Larry Hunsaker, PC manufacturing project manager and our tour guide, beamed as he showed us from one end to the other—as well he should: it was impressive.

Before describing the assembly line itself, I would like to share some of my observations of what was *on* the line. On the day of our visit IBM was building five-slot PC and eight-slot XT system units. Most of those PCs had one (!) or two diskette drives; some had *no disk at all*. Hunsaker shrugged at my surprise that diskless PCs were being assembled, saying that he builds what the order says to build. IBM's volume for such systems is probably small; the manual labor content for no-disk PCs is higher because IBM has not automated its cassette-port diagnostics procedure.

PCs with disks are automatically transported on a conveyer system from the start of the line (the "kitting" operation) to the end (boxes on a pallet). Kitting consists of collecting the required components onto a tray upon which the computer travels until it is placed in the box. Thereafter, it is handled by people only for assembly, which consists of mounting the system board, inserting and fastening disk drives, fastening the power supply, connecting wires, and putting on the cover. A visual check is made for telltale mars or dirt.

Once the system unit is assembled (except for cover), it travels through a



series of tests. The first is quick, just enough to verify that the machine is alive and to prevent dead units from entering the next stage of testing, a three-hour burn-in. Following the burn-in, a final quick test is conducted. Systems failing any of these automatic tests are routed to manual stations for check-out and repair; as soon as a technician has made the unit operational, it is conveyed backwards on the line to reenter the testing phase.

After the machine is assembled, tested, and covered, it is ready for packing and shipping. On my previous visits this process had seemed very people-intensive, despite the machines IBM used to reduce heavy work. (Packers even use a device to lift the computer off the tray, hold it while a bag is put on it, and drop it into the box.) At great expense, IBM has completely automated this last stage of manufacture.

From the assembly area, machines are conveyed to a sorting area. Each one is tagged with bar code; each tray is also tagged. Using these aids, the line sorts machines into groups of 12, the number of boxes IBM places on one shipping pallet. When 12 of a single type are collected, they are released as a group to the final stage, wrapping and packing. The sorting area is needed because the single assembly line can be

producing several different models of PCs and XT's at the same time. The order in which machines arrive for packing is therefore unpredictable and must be accounted for.

The wrapping operation is interesting. A final, mechanical inspection is performed to be sure the assembly is complete. Units missing a part in this last inspection are rejected, but IBM obviously does not expect this to happen because the rejection area can hold two trays at most. Machines then remove the system from the tray, wrap it with plastic (a little magic here: how do you hold something, yet wrap it all the way around?), and insert it in a box. Boxes are simultaneously being fabricated and loaded with bottom packing material, arriving just in time to receive their contents. Top foam is put in place, books and warranty information are inserted, and the box is closed and taped.

Labeling the box used to be a manual process. On this line, however, the bar code of the machine is scanned just before it is placed in the box and the information is then used to operate two large ink-jet printers that directly label both sides of the box. At the end of the line, the completed boxes are stacked on a pallet, which is then wrapped with a strong plastic film. Finally, a human being arrives with a forklift to remove

ILLUSTRATION • MACIEK ALBRECHT

DIRECTIONS

the pallet from the line and transport it to the shipping area.

IBM will not comment on production quantities. Noting that burn-in seemed to be the critical path, I calculated that a single shift working a five-day week could produce about 700,000 units per year.

Why this long description of IBM manufacturing? This particular manufacturing line could be used to build any IBM computer with roughly the same form/factors of the PC, such as the AT or some new model. It also represents the state of IBM art in the manufacture

of desktop computer systems; that state is highly automated and cost-effective, showing IBM's commitment to its reputation for advanced manufacturing techniques. Finally, greater efficiencies in manufacturing enable IBM to maintain higher margins while reducing prices.

IBM may have wished to communicate some messages to us without actually saying anything. One such message may have been that basic PCs, even diskless ones, are still in demand. It is interesting that PCs are still being made at all; I thought by now that XTs, with or without hard disks, would have

become the standard. However, the line was not operating at anywhere near its full capacity on the day of our visit. The end of the line, obviously very new, was out of service for adjustment; the packing operation had fallen back to semi-automatic operation. The possibility that the line was being tuned for a new model certainly crossed my mind.

Whatever the hidden messages, IBM can only be complimented for its beautiful, sparkling clean facility and efficient production. It is not exactly necessary to build our confidence; after all, this is IBM. Still, it is nice to see. ■■■■■

LANGUAGE SURPRISES

I am predisposed to believe that *PC Tech Journal*'s editorial staff really knows what's going on in the real world and that, consequently, we respond directly (albeit sometimes eventually) to our readers' needs. We are not expert in every area (keep this a secret, please), so we experiment by running articles in certain subject areas to gauge the audience reaction. I am usually gratified to learn that we correctly assess the interest in the subjects we publish. But we do get an occasional surprise; recently we got three.

In this month's Letters column you will find numerous responses to Alan Howard's review of FORTRAN compilers ("FORTRAN Options," October 1985, p. 149). The volume of comment on our coverage indicates a considerably larger interest in FORTRAN than we expected. That led us to conversations with more people in this segment of our audience and the industry that serves it, confirming that FORTRAN is alive and well. Microsoft says that its FORTRAN products continue to do well, and other vendors (more than you might expect) are healthy, too.

One particularly surprising comment is about FORTRAN's portability. Because it is not a systems programming language, programmers are apparently not as likely to exploit extensions supplied by a particular vendor, opting instead for a more standard approach. This portability extends beyond the desktop to the minicomputers and mainframes crunching FORTRAN. We were interested to learn that some programmers prototype FORTRAN programs on the PC that they later will execute for effect on a Cray.

PC Tech Journal will continue to observe the FORTRAN market and review those products that should interest our readers. Also, we will soon begin a quarterly series of articles on statistical methods; the program examples for these articles will be in FORTRAN.

Our coverage of COBOL compilers was completed in August ("COBOL Performs," Ted Mirecki, June, July, and August 1985). We have been following COBOL closely and are not surprised at its strength in the desktop marketplace. The advent of faster computers, such as the AT, and bigger and faster mass storage devices ensures that significant applications will be mounted on desktops. This will be especially true in corporate MIS departments as monolithic COBOL applications are decentralized.

We are also not surprised at the acceptance *PC Tech Journal* has received in the corporate sector, because MIS departments are part of our target audience and a market to which we actively aim. But we are surprised at the rate of growth in that segment of our audience. Our 1984 subscriber research study showed that 31 percent of our subscribers worked in corporate MIS departments; the number for the 1985 survey is 40 percent, a 29 percent increase. This evidences an increased need for technical and systems information at the MIS level and a corresponding rise in the number and complexity of the PC projects undertaken there. The assumption that COBOL will play a vital role is not unreasonable.

One of our correspondents (in a letter to be published in our April

1986 issue) complains "...one more article on COBOL compilers and I'll drop my subscription." Well, I dearly hate to lose subscribers, so I'm glad this letter arrived after our series of reviews was complete, but the future probably holds more COBOL in store. I just hope the rest of *PC Tech Journal*, in fact, the bulk of it, keeps our correspondent from carrying through with his diabolical threat.

Finally, we got a ton of mail about our coverage of CHASM ("PASM, TASM, and CHASM," Ted Mirecki, December 1985, p. 161). I was quite surprised to see how widespread this user-supported product was. A sampling of the letters will be published in next month's issue, but a general theme rang through. The letter writers called our review of CHASM "unfair" and objected to our description of it as a "toy" compiler. They argued quite persuasively that CHASM had its place and that not everyone writes large assembly programs or needs a full-blown product to handle little routines.

Perhaps we were harsher on CHASM than we should have been. This is not to say we consider our presentation flawed; indeed, the article is factual and complete. Our error may lie in not having a better perspective of how CHASM actually was being used and thus overlooking its advantages for those situations. As usual, we appreciate your feedback and your careful attention to our material.

In each of these three cases we were surprised by the high level of interest displayed by our audience. Thanks for keeping us alert.

—WF

SAVE OVER 30% ON OUR GIFT PACKS!
60-DAY MONEY-BACK GUARANTEE

How Borland's Three New Holiday Packs Will Fill Your Stocking Without Emptying Your Piggybank.

Three special packs with dazzling discounts that will help get you into a Holiday mood. You can get some of Turbo, most of Turbo, or all of Turbo—including the two newest members of the Turbo family, Turbo GameWorks™ and Turbo Editor Toolbox™. You also get our unmatched 60-day money-back guarantee, quality products that aren't copy-protected.

TURBO NEW PACK \$95.00.

You get the two exciting new members of the Turbo Pascal family,

- TURBO GAMEWORKS, Chess, Bridge, and Go-Moku, complete with source code and a 200-page manual.
- TURBO EDITOR TOOLBOX, all the building blocks to make your own editors and word processors, complete with source code and a 200-page manual.

TURBO HOLIDAY PACK \$125.00.

You get all three of the Turbo family classics for only \$125.00 (about a 30% discount). Turbo Pascal 3.0 and Turbo Tutor and Turbo DataBase Toolbox—all for just \$125.00.

- TURBO PASCAL combines the fastest Pascal compiler with an integrated development environment.
- TURBO TUTOR teaches you step-by-step how to use Turbo Pascal with commented source code for all program examples on diskette.
- TURBO DATABASE TOOLBOX offers three problem-solving modules for your Turbo Pascal programs: Turbo Access, Turbo Sort, and GINST, which generates a ready-to-run installation program that lets you forget about adapting your software to specific terminals.

TURBO HOLIDAY JUMBO PACK \$245.00.

This is it—the whole thing, the entire Turbo family including its two newest members. You get:

- Turbo Pascal
- Turbo Tutor
- Turbo GameWorks
- Turbo Graphix Toolbox
- Turbo DataBase Toolbox
- Turbo Editor Toolbox

and you pay only \$245.00 for all six! Which means that you're getting everything at only about \$40 a piece. Quite a holiday deal. (And if you already own one or several members of the Turbo family, be creative—nothing can stop you from buying the Jumbo Pack, picking out the ones you already have and giving the rest as holiday gifts to family and friends. At these prices you can afford to give to others and to yourself.) Speaking of Holidays, this offer lasts until March 31, 1986. (At Borland, we like to make the Holidays last.)

BORLAND
INTERNATIONAL

4585 SCOTT VALLEY DRIVE, SCOTT VALLEY
CA 93066. PHONE (408) 438-3400 TELEX 172873

CIRCLE NO. 250 ON READER SERVICE CARD

Copyright 1985 Borland International Bl-1017B

Turbo Pascal and Turbo Tutor are registered trademarks and Turbo DataBase Toolbox, Turbo Graphix Toolbox, Turbo Editor Toolbox, Turbo GameWorks, and MicroStar are trademarks of Borland International, Inc. WordStar is a trademark of Microsoft International Corp. Multi-Mate is a trademark of Multi-Mate International Corp. Microsoft is a registered trademark and Word is a trademark of Microsoft Corp. WordPerfect is a trademark of Salient Software International.



NEW!

TURBO GAMEWORKS

\$69.95.

Our new Turbo GameWorks offers games you can play and replay without Turbo Pascal or revise and rewrite with Turbo Pascal 3.0. We give you the source code, the manual, the diskettes and the competitive edge. Chess, Bridge and Go-Moku. State-of-the-art games that let you be player, referee, and rules committee all at once because you have the Turbo Pascal source code. Learn exactly how the games are made—so you can go off and make your own. And Turbo GameWorks is the only quality game you can buy that is not copy-protected. Sold separately, only \$69.95. (Just \$47.50 if you buy the Turbo New Pack.)

NEW!

TURBO EDITOR TOOLBOX

\$69.95.

Build your own word processor—for only \$69.95!

You get ready-to-compile source code, a full-featured WordStar™-like word processor, and a 200-page manual that tells you how to integrate the editor procedures and functions into your programs. With Turbo Editor Toolbox, you can have the best of all word processors. You can make WordStar behave like Multi-Mate. Support windows just like Microsoft's Word. And do it as fast as WordPerfect does it. Incorporate your new "hybrids" into your programs to achieve incredible control and power. Sold separately, only \$69.95. (If you buy the Turbo New Pack, the price drops to just \$47.50.)

**Holiday Gift Packs,
Turbo GameWorks™
& Turbo Editor Toolbox™**

NOT COPY-PROTECTED

Available at better dealers nationwide. To order by Credit Card call (800) 255-8008, CA (800) 742-1133.
Quantity _____

Make checks payable to:
Borland International.

The holiday packs include an upgrade coupon for both options so you get BCD and 8087 support for \$39.95 (regularly \$55.00).

Carefully describe your computer system!
Mine is: — 8-bit — 16-bit
I use: — PC-DOS — MS-DOS
— CP/M-80 — CP/M-86

My computer's name and model is:

The disk size I use is: 3 1/2" 5 1/4" 8"

Name: _____
Shipping Address: _____
City: _____ Zip: _____

State: _____ Telephone: _____

*Gift Pack
Offers Last
Until March 31,
1986

*Turbo Holiday Jumbo Pack	\$245.00
*Turbo Holiday Pack	\$125.00
*Turbo New Pack	\$95.00
Pascal	\$69.95
Pascal w/8087	\$109.90
Pascal w/BCD	\$109.90
Pascal w/8087 and BCD	\$124.95
Turbo DataBase	\$54.95
Turbo Graphix	\$54.95
Turbo Tutor	\$34.95
Turbo Editor	\$69.95
Turbo GameWorks	\$69.95

These prices include shipping to all U.S. cities. All foreign orders add \$10 per product ordered.

Amount: (CA add 6% tax) _____

Payment: VISA MC Check Bank Draft

Credit Card Expiration Date: _____ / _____

Card # _____ / _____ / _____ / _____

COD's and Purchase Orders will not be accepted by Borland International. California residents: add 6% sales tax. Outside USA: add \$10 and make payment by bank draft, payable in U.S. dollars drawn on a U.S. bank.

H6

NOTE: Turbo Editor Toolbox and Turbo GameWorks are available for the IBM PC and true-compatibles using Turbo Pascal 3.0 ONLY.

Now You Know Why **BRIEF** is BEST

"BRIEF, The Programmer's Editor, is simply the best text editor you can buy." John Dvorak, INFOWORLD 7/8/85

The Program Editor with the BEST Features

Since its introduction, BRIEF has been sweeping programmers off their feet. Why? Because BRIEF offers the features **MOST ASKED FOR** by professional programmers. In fact, BRIEF has just about every feature you've ever seen or imagined, including the ability to configure windows, keyboard assignments, and commands to **YOUR** preference. One reviewer (David Irwin, DATA BASED ADVISOR) put it most aptly, "(BRIEF)...is quite simply the best code editor I have seen."

Solution Systems™

SOLUTION SYSTEMS, 335-P WASHINGTON ST., NORWELL, MA 02061, 617-659-1571

BRIEF is a trademark of UnderWare

COMPILER SUPPORT

No matter what compiler you have, it will run inside BRIEF. If errors occur during compilation, the supplied macros place your cursor on the line with the first problem and display the compiler's message. After you make your corrections, you skip to the next error with one keystroke. BRIEF automatically moves your cursor to the right place, even if you've added or deleted lines.

BRIEF is preconfigured (using the built-in macro language) for the Microsoft Macro Assembler v 4.0, and the Microsoft, Computer Innovations, Lattice, and Wizard C compilers. If you use another product, you can modify the macros to support it.

Every Feature You Can Imagine

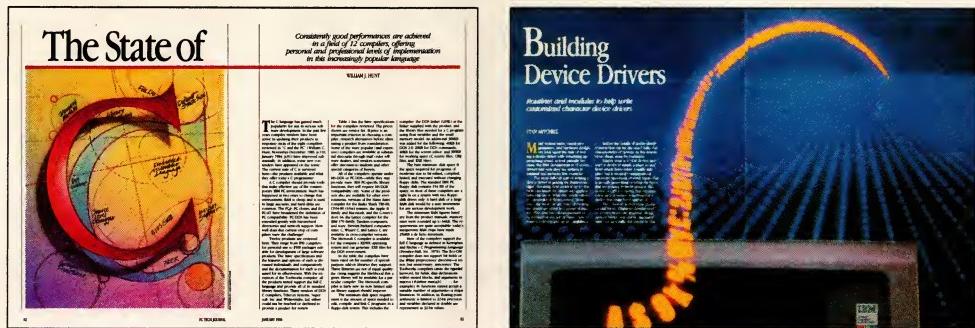
Compare these features with your editor (or any other for that matter).

- FAST
- Full UNDO (N Times)
- Edit Multiple Large Files
- Compiler-specific support, like auto indent, syntax check, compile within BRIEF, and template editing
- Exit to DOS inside BRIEF
- Uses all Available Memory
- Tutorial
- Repeat Keystroke Sequences
- 15 Minute Learning Time
- Windows (Tiled and Pop-up)
- Unlimited File Size -(even 2 Meg!)
- Reconfigurable Keyboard
- Context Sensitive Help
- Search for "regular expressions"
- Mnemonic Key Assignments
- Horizontal Scrolling
- Comprehensive Error Recovery
- A Complete Compiled Programmable and Readable Macro Language
- EGA and Large Display Support
- Adjustable line length up to 512

MONEY-BACK GUARANTEE

Try BRIEF (\$195) for 30 days - If not satisfied get a full refund.
TO ORDER CALL (800-821-2492)

NOT COPY PROTECTED

**.COM SUPPORTED HERE?**

In January's "The State of C" article (William J. Hunt, p. 82), table 1 refers to the Microsoft C compiler allowing a .COM memory module. I called Microsoft to find out what I missed in the documentation that supports creating .COM files from C source code, and was told it was not a feature of this compiler. Do you refer to just memory module size, or is there a way to get the compiler to create .EXE files that can be converted to .COM files?

*Jerry Dellasala
New York, NY*

Thanks for the correction. The Microsoft C compiler does not support .COM files.

—DB

A GRAPHIC RESOLUTION

Upon reading the letter from John M. Scott Bryan, Ph.D., in the October issue of *PC Tech Journal* (Letters, p. 15), I have realized that there is a lot of confusion among owners of the Professional Graphics Controller (PGC) and I hope that my letter will help to clarify some of these misunderstandings.

When I received my PC/AT with the PGC, I could not wait to try it with my PC-PLOT terminal emulation program, which claims support for PGC, and see the superb graphics on the screen. I did not have to wait long; as soon as I started the PC-PLOT program, I experienced problems similar to those of Mr. Bryan. When I selected communications speed above 1200 baud, PGC was consistently losing characters. After swapping PGC with EGA, I learned that this problem was related to the presence of PGC in my PC.

At this point, I decided to call IBM. Fortunately for me and now for Mr. Bryan and others, I was more successful. The IBM representative with whom I spoke was very knowledgeable and supportive. He told me that all PGCs with serial numbers 6323697 to

6448811 had the described problem and the IBM was now able to correct it.

I found that my PGC had serial number 6323698. I sent it to the IBM service center and the problem was fixed within a few days. Today I can communicate with our mainframes at 9600 baud without losing characters.

Two things bother me. First, PC-PLOT supports PGC only in the mode emulating CGA, so as yet I have no high-resolution graphics. Second, I wonder how Mr. Bryan and you (I assume that you agree by not commenting his letter) could think that PGC was losing characters due to the slow performance in text mode if the problem occurred only when the communication port was used and not during tasks like listing files on the screen.

*Frank Klatil
Rutgers University
Piscataway, NJ*

Mr. Bryan's letter was checked to the extent that we verified that the problem existed. We then published the letter as a way of informing our readers of the problem. We appreciate your further clarification, especially your report of success in dealing with IBM.

—WF

DRIVING AWAY BUGS

I would like to add several observations to Stan Mitchell's "Building Device Drivers" (May 1985, p. 76). Recently I wrote a device driver for an IEEE488 parallel general purpose interface bus.

Although these drivers are difficult to debug, several tools are available to the programmer. The first strategy is to post the device drivers location in the user software interrupt vector (60 to 67H) at initialization time. This will allow the debugger to find the driver in the maze of the DOS driver pool.

The second strategy involves postponing the execution of the initialization code until the first call to the de-

vice driver. The programmer using this technique should code the real initialization routine to simply point to the end of the driver routine and set the interrupt vector as noted above.

With the interrupt vector pointing to the device driver, the user can now find the device driver and, more importantly, use the debugger to set breakpoints within the driver. Care must be taken, however, not to trace execution too far outside the module's boundaries because DOS is not reentrant.

*John T. Cockerham, M.D.
The Children's Hospital
Boston, MA*

Dr. Cockerham offers some good suggestions for debugging device drivers. These are methods that the novice will find useful and that the experienced programmer should keep in mind when all else fails in cracking a tough bug.

—Stan Mitchell

A BASIC DISAGREEMENT

It's about time someone brought to your attention the advantages of BASICA and the new IBM BASIC Compiler 2.0.

Many references have been made by readers and by your columnists about the greatness of C and Pascal and how poor BASICA is with regard to implementation and speed. C and Pascal are fine languages, but the 2.0 version of the BASIC compiler, plus maybe one or two callable machine language routines, can put those languages to shame.

Every conceivable routine can be implemented and all 640KB in a PC can be used by this improved BASIC. Plus, the speed of execution on a PC with an 8088 is acceptable while on an 8088-2, 8086, or 80286 machine it is impressive.

A programmer does not have to worry about what variable is what and can add new ideas as he thinks of them without much regard to starting over each time. The BASIC Compiler 2.0 allows a programmer to make the appli-

LETTERS

cation memory resident through the SHELL statement, plus fine graphics, communications, dynamic arrays, and submodules are included.

I've only had the compiler for a month, but with the tremendous help from the technical support people at IBM, I have become an expert on the use of the compiler in a short time.

I. N. Botnick
President
T.B.S.P., Inc.
Los Angeles, CA

In forthcoming issues, PC Tech Journal will be reviewing many current BASIC compilers and interpreters.

—JD

THE CORRECT TEST

The September issue had an interesting article by Cole Brecheen ("Improving Turbo's I/O," p. 104). I downloaded the files to use several of the procedures. One procedure (which is listed in ANSISTUF.INC) named SCRNSAVE has a bug. When I tried to use it, I got the "Too little memory to save screen" message despite my 640KB of RAM.

Maxavail will return a negative number if enough memory is available so it must be tested for sign as de-

FIGURE 1: SCRNSAVE

```
If maxavail < 0 then
  avail_paragraphs := 65536.0 + maxavail;
  else avail_paragraphs:=maxavail;
if avail_paragraphs * 16.0 < 1.0 * size then
  abort( 'Too little memory to save screen.' );
```

This code modifies SCRNSAVE (in ANSISTUF.INC for "Improving Turbo's I/O") to test for adequate memory.

scribed in the Turbo Pascal manual. (Figure 1 shows the correct test, in which avail_paragraphs is a real.)

Ben L. Ettelson
Walnut Creek, CA

Mr. Ettelson makes a good point. Procedure SCRNSAVE has been modified on PCTECHline and now includes all of the corrections shown above.

—Cole Brecheen

HARD TIMES

It seems that every time you review software that I am interested in, the benchmark times are for a floppy disk. I think this is inadequate. Hard disks are available for \$400 or less. How many of your readers have hard disks? Have you ever tried doing software development

without one? An IBM PC/XT with a 10MB hard disk and 256KB RAM should be considered the minimum.

(I find the graphic arts format of your magazine to be one of the best of all similar magazines on the market.)

Paul Mann
Tustin, CA

You are correct, to a point. Our most recent subscriber research indicates that 85 percent of our readers' companies own hard disks. The percentage is about 60 percent for personally owned systems. Therefore, the need remains for information on floppy disks.

However, we recognize the trend toward inexpensive hard disks. Our feature articles on data management, for example, ignore floppy disks entirely; the benchmarks for those products are performed on an AT. We avoid the XT because so many have been sold with non-IBM drives (the performance of which varies wildly). The AT, at least, has a published specification for minimal performance.

—WF

Thanks for the words of encouragement about our magazine's design.

—IS

Parlez-vous Pascal?

Mais oui.

After you've digested this, you will.

Introducing "Exploring Pascal: A Compiler For Beginners."

The fastest way on the planet to learn and use Pascal.

So you can put some of your programming ideas to work, to accomplish your specialized needs. And have the power of a pseudo-compiler, too.

It's fast because we make it as easy as possible.

Exploring Pascal is a unique, multimedia book and disk learning system.

The manual is very easy to read. Because you don't want to have to struggle with the

English language to learn a new computer language.

The software tutorials are interactive, and the exercises are computer graded. So you know how you're doing, every step of the way.

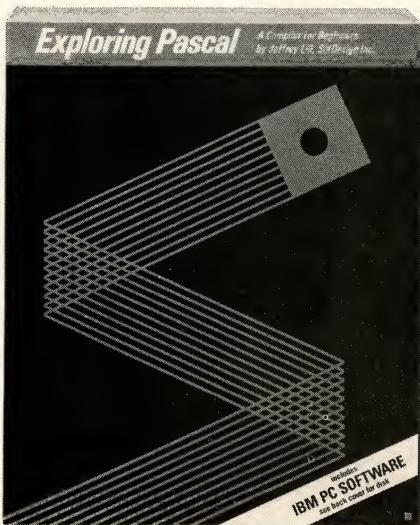
And there are animated demonstrations of important concepts.

400 screens of help in all.

To order, for the name of your nearest dealer, or for more information, just call the Ashton-Tate Publishing Group at 800-437-4329, Ext. 249.

If you're computer literate and are ready to step up to computer programming, it's really très bon.

Trademark/owner: Ashton-Tate. © 1986 Ashton-Tate. All rights reserved. Specifications subject to change without notice.



CIRCLE NO. 235 ON READER SERVICE CARD

Create your own communications software



with The RELAY Gold Customizer's Toolbox

Create your own masterpiece and unleash the power of your PC by designing customized communications software with RELAY Gold™ and The RELAY Gold Customizer's Toolbox™.

As you know, the best applications are consistent in design, completely integrated, and take little or no time to master. The Customizer's Toolbox lets you develop just those kinds of applications. Create your own screens, menus, and help panels to seamlessly integrate communications into the rest of your application.

With your customized applications, accountants concentrate on accounting, order entry clerks enter orders, and word processing people do their word processing, without having to learn about communications. You can automate any procedure for them with RELAY Gold's powerful Script Language. Complex communications tasks become easy, automatic, and transparent.

But that's just the beginning. Your users can emulate TTY, TELEX, VT100, and 3270 terminals with RELAY Gold. Transfer any kind of file, 100% error-free. And the best news is they can still use other packages like LOTUS, while sending and receiving files.

RELAY received the highest "over-all rating" in Software Digest's October Ratings Newsletter. And Teleconnect Magazine says RELAY Gold "just might be for communications what 1-2-3 has been for spreadsheets. It's simply the best communications package I've seen." Call today for a 30 day trial.

The RELAY Family™

RELAY Gold™ lets you run other programs while you communicate. The RELAY Gold Customizer's Toolbox™ lets you design your own communications software. RELAY/3270® mainframe software lets any number of PCs emulate 3270s, anywhere there's a telephone. RELAY/TSO™ and RELAY/VM® provide 100% error-free micro-to-mainframe file transfer.

**personal
Computing**
800-84-RELAY
(CT 203-798-6755)

41 Kenosia Avenue Danbury CT 06810

CIRCLE 194 ON READER SERVICE CARD

At last! - Fast, On-screen

FLOWCHARTS

And Organization Charts

Finally! An on-screen flowchart processor that knows about flowcharts and organization charts - not just another "screen draw" program that makes you do most of the work.

Interactive EasyFlow is a powerful full-screen graphics program dedicated to flowcharts and organization charts. With this program you can quickly compose charts on the screen. More important, you can easily modify charts so they are always up to date.

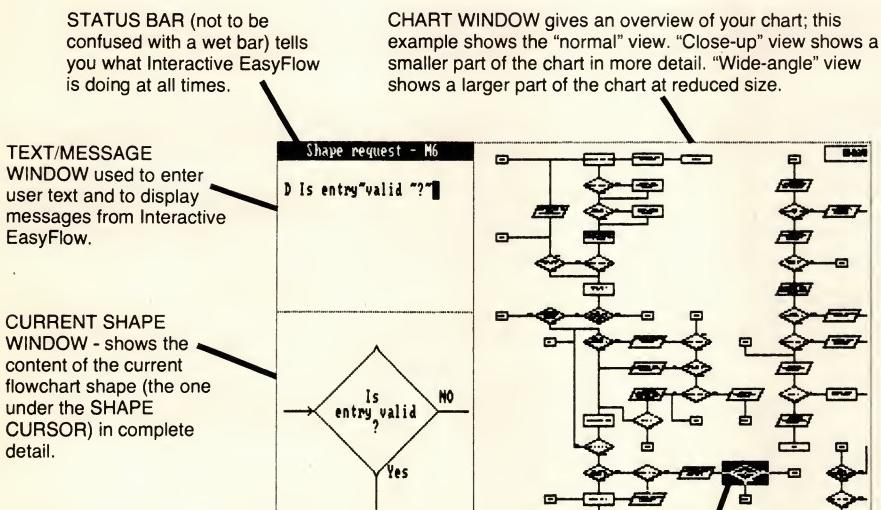
Features: • Text is automatically centered, character by character, within shapes as you type it • Text formatting controls allow you to over-ride the automatic formating where desired • Lines are created by specifying the starting and ending points - the program automatically generates the route • Powerful editing facilities allow shapes and even entire rows and columns of shapes to be inserted or deleted; lines are automatically re-routed as necessary • Large chart size (up to 16 shapes wide by 16 shapes high) allows very large flowcharts and organization charts to be handled with ease • Charts can be larger than the screen - the window into the chart scrolls both horizontally and vertically as necessary • Flexible printer interface allows it to work with all

printers, not just dot matrix printers. Wide charts can be printed in strips Also works with Hewlett-Packard 7475A (and compatible) plotters • Twenty standard flowcharting shapes included • Common shapes supplied in three sizes • Extensive manual (125 pages) includes many examples • Context sensitive "help" facility provides immediate assistance at any time • Any number of titles can be placed on a chart • Commentary text blocks can be placed anywhere in the chart • Fast: written in 8088 assembler • Plus many more features than we can mention here.

Requires at least 256K memory, DOS-2 or higher and an IBM or Hercules compatible graphics card.

Order direct for only \$149.95 + \$2.00 S&H (USA/Canada), \$10.00 (foreign). Payment by MO, check, VISA, COD or Company PO. Rush orders accepted (\$15.00 S&H; USA/Canada only). Rush orders received by noon will be delivered the next business day (to most locations).

The sample screen display shown below is typical of what you see while editing a chart. Other screen displays are provided for entering titles, changing options, getting "help" and so on.



HavenTree Software Limited
P.O. Box 1093-N
Thousand Island Park, NY 13692
(613) 544-6035 ext 48

CIRCLE NO. 113 ON READER SERVICE CARD

LETTERS

CURVES IN COLOR

Upon reading "Fractals for the PC" (Eui In Lee, November 1985, p. 165), I was surprised to find that the program listing produced monochrome curves, not the color ones shown. However, by changing lines 50 and 370 and adding lines 371-375 (see figure 2), DAM.ASC will produce the colored curves as pictured with the article.

Kenneth J. Kahn
Lawrence, NY

FIGURE 2: Revised DAM.ASC

```
50 SCREEN 1,0:COLOR 0,0:DEFINT I-R
370 N=N+1:S=S+1:IF S>3 THEN S=1
371 ON S GOTO 372,373,374
372 LINE -(X,Y),1: GOTO 375
373 LINE -(X,Y),2: GOTO 375
374 LINE -(X,Y),3
375 NEXT J
```

These replacement lines change portions of code listed with "Fractals for the PC" to produce color curves.

The modified DAM.ASC is available on PC TECHline as DAMCOLOR.ASC. It plots somewhat slower, but it will produce the color output that was printed with the original article.

—JD

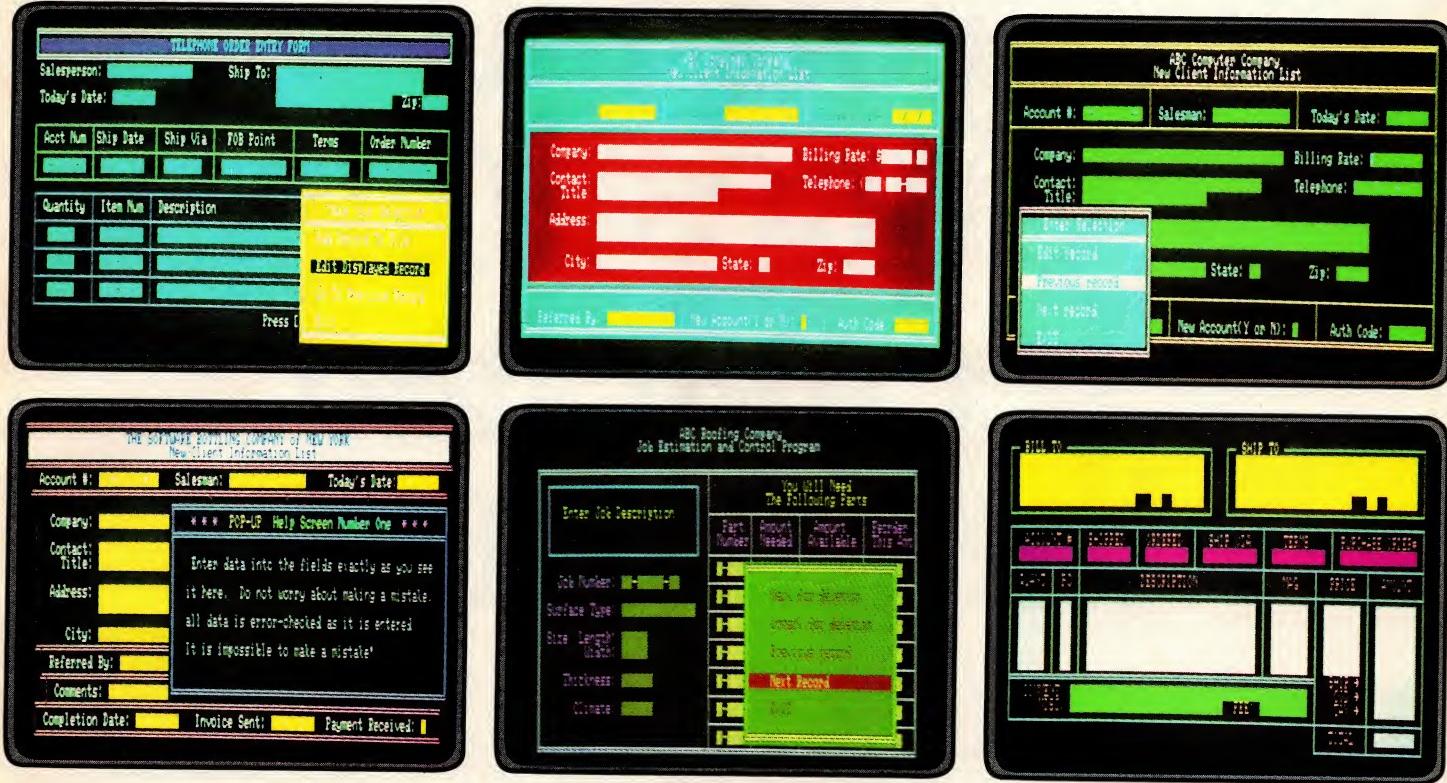
FURTHER ON FORTRAN

Thanks for the fine FORTRAN article in the October issue of *PC Tech Journal* ("FORTRAN Options," Alan Howard, p. 149). For a variety of reasons, FORTRAN continues to be the language of choice for many number-crunching programs, even on microcomputers.

Because I use FORTRAN with relatively large programs, I was somewhat disappointed that the benchmarks and discussions of the compilers did not deal with the problems encountered with larger programs. In particular, I have compared IBM Professional FORTRAN 1.0 with Microsoft FORTRAN 3.3 and came to a conclusion totally opposite to Mr. Howard.

I ran a benchmark on a simple Cholesky decomposition program with no pivoting. This is typical of my work, which deals with the handling of large linear systems of equations. My benchmark was run with double-precision real variables. The compilers were timed for performing a decomposition followed by a forward-backward substitution pass, thus solving a set of linear equations for one right-hand side vector. The tests were executed on a PC/AT with an 80287 numeric coprocessor.

Flashy Programs.



dBASE • Turbo Pascal • BASIC • C • COBOL • Fortran • Lotus 1-2-3...

FLASH CODE™

The most powerful program developer for dBASE II and dBASE III ever developed.

DRAW any screen design with our advanced screen editor. Use Flash Code and see how incredibly easy screen design can be.

GENERATE complete programs automatically. Based on your screen designs, Flash Code can write your whole dBASE program.

FLASH-UP WINDOWS™. Menus and Help Windows add a new dimension to your dBASE programs. Create them instantly with our window editor. Use the FlashUp™ module to have windows pop-up throughout your dBASE applications.

For dBASE II and dBASE III. \$150.

"...a truly remarkable product. Brand-new, state-of-the-art and actually fun to use. The windows make it an even more amazing product."

Cary N. Prague, Author
"Beyond programming with dBASE III"

"Destined to replace QUICKCODE™"
MicroNews/Vnews, Nov. 85

No Risk Demo Offer!

Here's a no-risk offer. Order now and you'll also get a full demo disk. Use the demo and the manual for 30 days. If you don't love it, return the package for a full refund.

SCREEN SCULPTOR™

You can create screens in minutes...then Screen Sculptor writes the program.

Move pieces of the screen around, select colors from a menu, draw boxes and lines, paint, repeat last character in any direction. And more!

Specify variable names, data types, acceptable data ranges, pictures for edit checking, etc.

Screen Sculptor then generates an actual program source code based on your screen design. Use it as is or modify it.

For BASIC, Turbo Pascal, IBM/Microsoft Pascal. \$125.

"...so well done that you may not need to refer to the manual."

"...an exceptional product that fills a real need in the development of new programs."
Computer Language

NEW! FLASH-UP WINDOWS™

An incredibly flexible and powerful tool for Flash-Up Menus and Flash-Up Help Windows!

Every program, every application becomes more sophisticated and easier to use with Flash-Up Windows.

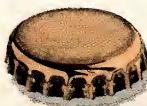
Use the window editor to instantly create windows. Change their size, location, color...all automatically. Specify a string of characters or control codes to send back to your application program.

The windows can be flashed-up directly by your program OR by the user with the keyboard. Windows can even call other menus or help windows.

An absolute necessity for BASIC, Turbo Pascal, C, R:BASE, COBOL, Fortran, dBASE, Lotus 1-2-3...

Introductory price. Only \$75.
(Until 3/31/86)

CIRCLE NO. 192 ON READER SERVICE CARD



THE
**SOFTWARE
BOTTLING
COMPANY
OF NEW YORK**

Requires an IBM PC, XT, PC AT or true compatible, 256K

**Credit card orders call 24 hrs/day
1(800) 824-7888, operator 268.**

All other orders and inquiries call or write
Software Bottling Co., 6600 L.I. Expwy,
Maspeth, NY 11378. 718-458-3700.

Before you had PC questions, Tecmar had the answers.

Five years ago when IBM introduced its PC, a Tecmar engineer flew to Chicago and bought the very first one.

Then he brought it back to Ohio, where we took it apart to see just what it could do.

And before most people even knew how PCs could work in their businesses, Tecmar was making them work better.

We had more than 20 kinds of PC add-ons in the hands of users before anyone else had one. And we've been offering the answers to PC questions ever since.

Today Tecmar makes the largest line anywhere of add-ons for IBM PCs and compatibles.

Expansion and multifunction boards for memory, speed, and connections. Tape drives and hard disks for data protection and storage. Networks, modems, and terminal emulators for communications. And graphics, voice, and video boards for look and sound.

All of them answers for offices and their PCs. All backed by solid service and warranties. Support from a company with over 10 years of success in an industry better known for quick failures (and stranded customers).

So if you have questions about how to make your PC do more and do it better, talk to the company that was there first. Tecmar.

The Answer.

TECMAR

6225 Cochran Road, Solon, Ohio 44139-3377. Phone (216) 349-1009, Telex 466692.
Chaussee de la Hulpe 181, 1170 Brussels, Belgium. Phone 32-2-672.23.98, Telex 20256.

CIRCLE NO. 225 ON READER SERVICE CARD

LETTERS

I recorded two sets of results: one compilation under the assumption that the adjustable arrays could not exceed 64KB, one assuming they could. (This involved the /B option for the IBM product and the \$LARGE metacommand for Microsoft.) The two compilers are comparable in speed when the arrays are limited. Moving to the larger array, Microsoft showed an increase in runtime of approximately 16 percent (from 26.64 to 30.81 seconds for 75 equations); IBM, however, was killed by an increase of 143 percent (from 28.07 seconds for the limited-size array to 68.33 seconds for 75 equations).

I was astonished by the huge increase in runtime for IBM when compiling with large arrays, so I created a simple program fragment that multiplies two vectors together [a]*[b]. Microsoft FORTRAN handles the segment selectors using the normal register arithmetic; IBM Professional FORTRAN uses the math coprocessor to do the integer arithmetic for the segment selection. While the math coprocessor is very effective in floating-point operations, using it to do the integer arithmetic for segment selection is just not right way to get the job done. Using the Intel timing data shows that just the simple expression SUM = SUM + A(I)*B(I) reflects the percentage increases in the runtimes discussed above.

If the large difference in execution time wasn't bad enough, IBM Professional FORTRAN does not support overlaid programs. Neither did the Lahey standard system (the last time I checked). An overlay structure is essential to a large FORTRAN program.

My experience with the compilation times also does not match Mr. Howard's. With my largest module of 806 lines, Microsoft compiled in 1:33 seconds (omitting PAS3, which is not required for normal use) versus 2:38 for IBM. I also prefer the compilation diagnostic scheme of Microsoft. Its default issues just the compilation errors to the screen. The IBM default just tells the user how many errors and warnings were found, but not where they are in the source code.

Mr. Howard chides Microsoft for using metacommands embedded in the source file for controlling 8087 code generation and other compiler options. This is a legitimate complaint when developing programs and wanting to try different compiler options, but once the compiler options have been decided, it is very convenient to have them built into the code and therefore not have to

Learn and Use AI Technology In Your First Evening With PROLOG-86

A complete *Prolog Interpreter, Tutorial, and set of Sample Programs:*

Modify and write Expert Systems.

Use the simple "Guess the animal" example on the Tutorial or use the sophisticated system for Section 318 of the US Tax Code written by one of the PROLOG-86 authors and published in the March, 1985 issue of Dr. Dobb's Journal.

Understand Natural Language

Use the sample program that produces a dBase DISPLAY command as output.

Programming experience is not required, but a logical mind is. Serious development of experimental systems is practical with PROLOG-86. 1 or 2 pages in Prolog is often equivalent to 10 or 15 in C.

RECENT IMPROVEMENTS: MSDOS commands, on-line help, load Editor.

AVAILABILITY: All MSDOS, PCDOS systems.

Write Symbolic Math or Abstract Problem Solving Applications

This is a complete Prolog program to convert from Fahrenheit to Centigrade: f_to_c(C,F):- C is(F-32) *5/9. Planning programs and games are included to help you learn.

BECOME FAMILIAR WITH PROLOG IN ONE EVENING.

**ONLY
\$125**

Full refund if not satisfied during first 30 days.



335-P Washington St.
Norwell, Mass. 02061
617-659-1571
800-821-2492

CIRCLE NO. 126 ON READER SERVICE CARD

LEARN LISP

Interactively and Write "Realistic" Programs with TransLISP for Only \$75

A "COMMON LISP" compatible Tutorial, Interpreter, Debugging, and Pretty Printer plus a Fast, Full Screen Editor, Samples and Help

Start Easily and Quickly:

A complete, modular tutorial helps you learn LISP at your own pace. An integrated, interactive environment provides all of the elements needed to enter, modify, analyze and debug programs.

Natural Language, Expert Systems and Mailing List:

Natural Language concepts are illustrated by a phone number retrieval program. Choose the best word processing program for you with the Expert System. File handling and typical data processing work are demonstrated by a Mailing List program.

Write Realistic Programs:

Short examples and substantial programs of about 10 pages in length help you learn by modifying, studying and using the key concepts needed to write programs of 1000 lines or more.

The "COMMON LISP" Standard:

TransLISP includes a 230+ function subset of the "COMMON LISP" Standard. Use extras like the MSDOS interface and graphics. Or use "strict compatibility" to make programs written in TransLISP, with no changes, work with other COMMON LISP systems like VAX LISP, GC/LISP or LISP Machine LISP.

Use and Modify the Mailing List program
to learn how to handle "normal" programming in LISP.

Runs on any MSDOS or PCDOS Systems: Not copy-protected, TransLISP is available in just about any 3", 5" or 8" format. PC compatibles can run TransLISP with no installation procedure. 192K memory and 1 floppy drive are the minimums required.

ONLY

For Beginners and Experienced Programmers

\$75

Full refund if not satisfied during first 30 days.



335-P Washington St.
Norwell, Mass. 02061
617-659-1571
800-821-2492

CIRCLE NO. 129 ON READER SERVICE CARD

IBM COMPATIBILITY at a not so IBM price



TECH PC/AT \$1999

PRICE INCLUDES:

- 6MHz 80286 CPU
- 512K
- One, 1.2 MB Floppy Drive
- 8 Expansion Slots
- 195 Watt Power Supply
- Complete MS DOS, PC DOS, Xenix Compatibility
- Runs Lotus 123, dBase III Framework and all other popular AT Software.
- ONE YEAR WARRANTY!!

OPTIONS:

- Tech PC/AT with 20MB Hard Disk **\$2399**
- Tech PC/AT with 20MB Hard Disk, Monochrome Monitor, Hercules® Compatible Mono/Graphics Card **\$2599**
- Also available with 6-8 MHz Switchable CPU, Tape Backups, Modems, Large Hard Disks, and Networking Systems.

TECH TURBO PC/AT \$2399
6-8 MHz Switchable 80286 CPU

TECH TURBO PC/XT \$1099

PRICE INCLUDES:

- 4 to 7 MHz Software Switchable CPU
- 640K
- Two, 360K DS/DD Floppy Disk Drives
- 8 Expansion Slots
- 135 Watt Power Supply
- ONE YEAR WARRANTY!!

OPTIONS:

- Tech Turbo PC/XT with 20MB Hard Disk **\$1699**
- Tech Turbo PC/XT with 20MB Hard Disk, Monochrome Monitor and Hercules® Compatible Mono/Graphics Card **\$1899**

TECH PC/XT \$799

PRICE INCLUDES:

- 4.77 MHz CPU
- 256K
- Two, 360K DS/DD Floppy Drives
- 8 Expansion Slots
- 135 Watt Power Supply
- ONE YEAR WARRANTY!!

OPTIONS:

- Tech PC/XT with 20MB Hard Disk **\$1399**
- Tech PC/XT with 20MB Hard Disk, Monochrome Monitor, Hercules® Compatible Mono/Graphics Card **\$1599**

TELEX: 272006
Answer Back-TECH
FAX: 714/556-8325

Visa, MasterCard, Check Accepted

TECH PC PERSONAL COMPUTERS

714/754-1170

2131 S. HATHAWAY, SANTA ANA, CA

©1985 TECH PC 92705
"Hercules" is a registered trademark of Hercules Computer Technology.

IBM, IBM PC, XT, and AT are registered trademarks of International Business Machines Corp.

CIRCLE NO. 240 ON READER SERVICE CARD

LETTERS

remember them every time one wants to recompile a module.

Based on my results, IBM FORTRAN is not the professional's choice for developing large FORTRAN applications. I am amazed that Ryan-McFarland advertises that "RM/FORTRAN is the fastest, most powerful FORTRAN made for the PC, XT, AT, or compatible," when this does not bear out.

Finally, DRI is not the only compiler of the four tested that supports both the large and small memory models (as the article stated). As I have just discussed, both IBM and Microsoft do. In addition, Lahey supports *only* the small memory model. I called Lahey and was told that its version 2.0 will be the first version to support over 64KB.

Bob Norton
Sunland, CA

*Mr. Norton has identified a significant problem with IBM FORTRAN with respect to the indexing of very large arrays—larger than 64KB. I contacted Ryan-McFarland and found that all integer*4 operations are performed using the 8087. Release 2.0 of the RM/FORTRAN compiler uses integer arithmetic for integer*4 operations including large array subscript calculations.*

I did not address the question of overlaid programs because they are normally provided by the linker and operating system, and, therefore, were beyond the scope of this review.

In my view, the use of embedded metacommands is a nuisance even when a single compiler has been selected for a project. Each source file must include the metacommands, whereas the use of a batch file or default include file solves the problem with no additional effort by the user.

I should have been more precise on definition of the memory models and size restrictions of the various compilers. I took the DRI definition for small model: code restricted to 64KB and all data restricted to 64KB. All other models were lumped together as large.

—Alan Howard

Your review of FORTRAN compilers was enlightening and I am glad to see that FORTRAN is being considered as a language for personal computers. I would like to offer some additional insights on both IBM Professional FORTRAN and the Microsoft compilers.

We ported a large process simulation program (about 12,000 executable lines) from a mainframe environment to the PC. Our concerns were the num-

ber of changes to be made, runtimes for selected problems, and code size. We used an AT with 640KB, an 80287, and a 20MB disk. Microsoft compiled it in 30 minutes with a link time of 10 minutes; its executable code size was 365KB and the runtime for a sample problem was 120 seconds. The comparable figures for IBM were a 60-minute compile time, link time of 10 minutes, executable code size of 415KB and sample problem runtime of 180 seconds.

The sample problem is a simulation of a pulp mill that we use to the test code on various machines. Comparable execution times are about 40 cpu seconds on a VAX 11/750 and about 2 seconds on an IBM 3081. The same FORTRAN code runs on all machines.

One major limitation of the Microsoft compiler surfaced. A 64KB segment (D group) is reserved for the stack, heap, program constants, file buffers, and other miscellaneous uses. Microsoft treats FORMAT statements as program constants and, hence, they reside in D Group; they are not relocated with the code. Programs with a large number of FORMATS may push D group to its limits. In our case, we had in excess of 58KB of FORMAT type data and thus were limited in file usage, after room was reserved for the stack and heap. Also, in version 3.2 (apparently corrected in version 3.3) data initializations of several arrays local to subroutines were "lost" or not done.

Professional FORTRAN was not without problems. The lack of nested INCLUDEs meant a lot of work with a word processor to get the code in a form acceptable to the compiler. Also, the number of constants that could be specified in a DATA statement in the BLOCK DATA subprogram was limited. An attempt to specify more than 140 separate items in the DATA statement (for a single array) generated a compiler error. Thus, DATA A/1200 * 0./ was acceptable, but DATA A/0,1,2,... was not (assuming A had been dimensioned with 1,200 elements).

Peter E. Parker
The Institute of Paper Chemistry
Appleton, WI

Thank you for your comments on a large system. It is clear from this letter and the others that no single compiler is right for every user. As Professor Maurie Halstead always said, "If there is more than one way to measure something, no one has found the right way."

—Alan Howard



TURBO PASCAL

Turbo Pascal, a leading new programming system and Programmer's Connection is your complete source for support libraries and utilities. We specialize in programmer's development tools specifically for IBM Personal Computers and take pride in providing the finest in selection, availability, price and service. We offer FREE standard UPS shipping and most of our products come with a 30 day NO RISK Guarantee. Here's a closer look at some selected products:

► ALICE: The Personal Pascal by Software Channels

Highly productive programming and learning environment for the Pascal language that consists of a syntax directed editor, an interpreter and a debugging facility. Syntax templates for every Pascal command provide immediate syntax layout and reduces keying. Because ALICE knows the rules and syntax of Pascal, it's impossible to create a program with syntax errors. User controlled indentation creates structured programs without having to set tabs. There are also Undo and Redo commands for correcting mistakes. During debugging, you can single-step or trace program execution while the cursor follows the currently executing commands. A Code Hiding feature gets commonly used routines out of the way while debugging. Immediate execution mode allows dynamic changing of variables and program statements while the program is running. Source code created using Alice can be compiled with your favorite Pascal compiler including Turbo Pascal and MS Pascal. All these features, combined with its dynamic HELP facility with over 500 screens of on-line help, make ALICE a uniquely productive tool for the Pascal language. Requires 256K memory.

Btrieve 245 199
► by SoftCraft Xtrieve 195 169
Rtrieve 85 79

Memory resident library of high speed, B-tree file management functions for Turbo Pascal and other languages such as APL, BASIC, C, COBOL, FORTRAN and MS Pascal. With this system, you can create very large files and quickly access records by key values. Its advanced, built-in data integrity feature prevents the incomplete updating of files due to power failure. New records reuse the space made available by deleted records. When a file grows to fill a disk, it can span two physical disks for that one logical file. Xtrieve is a powerful, menu-driven system for displaying and editing information from Btrieve databases. It supports a wide range of retrieval criteria and can perform basic mathematical calculations of information including counts, sums, averages, maximum and minimum values. Rtrieve is a menu-driven report writer used with Xtrieve for generating customized reports, form letters, mailing labels and statements. No royalties on applications created with Btrieve.

FirsTime for Turbo Pascal 75 69
► by Spruce Technology

Syntax directed text editor for Turbo Pascal that takes care of the low level syntax details of your program. You can generate complete statement skeletons with one keystroke. It finds syntax errors and reformats statements after changes. It can also identify errors such as undefined variables, types and constants, assignment statements with type mismatches and errors in include files and macro expansions. Also available for the C language (\$239) and MS Pascal (\$199).

**On-Line Help
from Opt-Tech Data Processing** 149 119

Powerful utility for adding help windows and instruction screens to your programs. You create the help texts with your own text editor and then use the On-line Help Library Manager to translate them into a compact library. You make calls in your code to the library interface to retrieve and display the text in windows. The utility can be interfaced with many different languages. It's fast, compact and an ideal way to add highly maintainable, on-line help to your system.

**Turbo ASYNCH
by Blaise Computing** 100 89

Library of interrupt-driven, asynchronous communications functions for Turbo Pascal. Features include initialization of COM ports, data transfer between circular queues and communication ports, simultaneous buffered input and output to both COM ports, user-defined buffer size, speeds to 9600 baud and XON/XOFF protocol. It installs as a memory resident runtime system and requires about 3.2K of memory. No royalties and includes source code.

Turbo Pascal® is a registered trademark of Borland International, Inc.

► Screen Sculptor by Software Bottling of NY

LIST OURS

125 109

Complete, easy to use system for creating full-screen input for Turbo Pascal and BASIC programs. Screens are created and edited with an interactive screen editor and then transformed into customized, fully-commented, program source code. The editor includes an on-line help system and allows you to draw lines and boxes, enter and manipulate fields and text, resequence input fields, repeat the last character and more. Field definitions include character validation types (pictures), color attribute control, input masks, variable names, initial values, range checks, protected characters and much more. The screen editor requires 128K memory.

70 49
► Turbo Pascal with 8087 or BCD 110 79
by Borland International with 8087 and BCD 125 85

Popular, small memory model implementation of the Pascal language that provides very fast compilation and execution of programs. The easy to use, full screen text editor is integrated into the compilation process to allow fast debugging of programs. When the compiler encounters a syntax error, it displays the affected code, enters edit mode, allows you to correct the error and then instantly recompiles. It supports color, sound, DOS paths, windowing, turtle graphics, I/O redirection and much more. Automatic overlays are provided so that large programs can run on small systems. Included is a sample spreadsheet program with complete source code. If your computer has a math coprocessor chip, the optional 8087 support will provide faster execution of programs that use floating point. The optional BCD package provides binary coded decimal arithmetic routines that eliminate roundoff errors. The high quality and low cost of this widely used Pascal compiler makes it a super system for professional software development. Turn the page and refer to the section entitled Turbo Pascal and Utilities for a complete price list for all Borland Turbo Pascal support products and much, much more.

► Turbo POWER TOOLS by Blaise Computing

100 89

General purpose library of functions for Turbo Pascal. Includes extensive string handling, high speed screen and window management and access to BIOS and DOS services. It also provides the ability to build interrupt service routines and execute other programs including DOS commands and batch files from the calling program. No royalties and includes source code.

► Turbo Professional by Sunny Hill Software

New version 70 59

Library of functions for creating memory resident routines that can pop up from within other applications at a keystroke. Features include interrupt service routines with control of CPU registers, keyboard macros, BIOS keyboard control, high-level access to environment variables, DOS memory allocation and DOS program execution. Also includes a high speed windowing and screen system, easy DOS date/time access, concurrent printing under DOS 3.x and various sample programs. This new version now adds raw disk I/O, directory searches, 8087 support for pop ups and much more. Includes complete source code in Pascal and Assembler with no royalties. Requires 128K memory.

► TurboPower Utilities by TurboPower Software

95 89

Set of Turbo Pascal programming utilities that includes a pretty printer, Pascal structure analyzer, execution profiler and execution timer. Also includes a pattern replacer, difference finder, command builder, file finder and super directory. Includes 500K of complete documented source code and 140 page user manual. Requires 192K memory.

**CALL TOLL FREE: U.S.; 800-336-1166
CANADA; 800-225-1166 OH; 216-877-3781**

CIRCLE NO. 175 ON READER SERVICE CARD

**programmer's
connection**

programmer development tools

3/86

NO SHIPPING CHARGE
When shipping via standard United Parcel Service.
NO HANDLING CHARGE
Orders are expertly prepared for a safe trip in state, out of state or out of the country.
NO INSURANCE FEE
All shipments within the United States are insured for their full value.
NO RISK
If dissatisfied with purchase, return it within 30 days for a refund. See our NO RISK GUARANTEE for details.

apl and utilities

	LIST	OURS
APL+PLUS/PC System by STSC	New version	595 449
APL+PLUS/PC Tools Vol 1 by STSC	295	239
APL+PLUS/PC Tools Vol 2 by STSC	85	69
Btrieve by SoftCraft	250	199
Financial/Statistical Library by STSC	275	219
Pocket APL by STSC	95	79
STATGRAPHICS by STSC	695	539

artificial intelligence

Expereteach by Intelliware	Complete System	475 399
EXSYS Expert System Development Software		395 339
GCLISP Golden Common LISP by Gold Hill	All Models	Call Call
Insight I by Level Five Research	AI Primer	95 79
Insight II by Level Five Research		485 399
LISP by Microsoft		250 189
Methods Prototyping Utility by Digitalk		250 219
Prolog-86 by Solution Systems		125 Call
Small-X by Kaplan	New	Call Call
UNXLISP by Cybermetrics	New	70 59

assemblers and debuggers

8088 Assembler w/Z-80 Translator by 2500 AD	100	89
Advanced Trace-86 by Morgan Computing	175	149
CodeSmith-86 Debugger by Visual Age	145	129
Microsoft Macro Assembler with utilities	150	109
Pasm86 Macro Assembler by Phoenix Software	295	219
Periscope Debugger by Data Base Decisions	295	269
Periscope II by Data Base Decisions	145	129
PfFinish Performance Analyzer by Phoenix	395	289
Pfix-86 Plus Symbolic Debugger by Phoenix	395	289
The PROFILER by DWB Associates	125	109
Turbo EDITASM Fast Assembler by Speedware	99	89
Visible Computer: 8088 by Software Masters	70	59

basic language

BetterBASIC by Summit Software	200	169
8087 Math Support	99	89
Btrieve Interface	Used with Btrieve	99 89
Run-time Module		250 239
Microsoft QuickBASIC Compiler	99	79
Professional BASIC by Morgan Computing	99	79
8087 Math Support	50	47
True Basic from Addison-Wesley	150	119
Run-time Module	500	459

blaise products

Asynch Manager for C or Pascal	175	139
C Tools	125	109
C Tools 2	100	89
Combination package	175	149
Exec Program Chainer	95	84
Pascal Tools	125	109
Pascal Tools 2	100	89
Turbo ASYNCH for Turbo Pascal	100	89
Turbo POWER TOOLS for Turbo Pascal	100	89
View Manager for C or Pascal	275	219
with Source Code	295	239

c interpreters

C-terp by Gimpel Software	300	249
Instant C by Rational Systems	500	379
Introducing C by Computer Innovations	125	109
Run/C Lite from Lifeboat	150	109
Run/C Professional from Lifeboat	250	199

c compilers

	LIST	OURS
C-86 Compiler by Computer Innovations	395	299
Datalight C Compiler	60	49
DeSmet C Compiler w/Source Debugger	159	145
Eco-C Development System by Ecosoft	100	89
Lattice C Compiler from Lattice	500	Call
Lattice C from Lifeboat	500	299
Let's C Compiler by Mark Williams	75	69
with csd Source Level Debugger	150	129
MWC-86 by Mark Williams	495	379
Microsoft C Compiler	395	259
Wizard C by Wizard Systems	450	389

c utilities

Call us for availability of specific compiler interfaces.

	LIST	OURS
APT Toolkit by Shaw American Technology	395	339
Asynch Manager by Blaise Computing	175	139
Basic_C Library by C Source	175	139
Btrieve by SoftCraft	250	199
C Cross Reference Generator by Lattice	50	39
C-Food Smorgasbord by Lattice	150	109
C-lib by vance info systems	195	139
The C Library by Kris Jamsa Software	90	79
C Power Packs by Software Horizons	Call	Call
C-Sprite Program Debugger by Lattice	175	139
C to dBase by Computer Innovations	150	139
C Tools by Blaise Computing	125	109
C Tools 2 by Blaise Computing	100	89
c-tree by FairCom	395	329
C Utility Library by Essential Software	185	139
C Windows by Syscom	100	89
C Wings by Syscom	50	45
CI Probe Source Level Debugger	225	199
CI ROM Pack for C-86	195	149
Curses Screen Manager by Lattice	125	109
with Source Code	250	219
dBC dBase File Manager for C by Lattice	250	199
with Source Code	500	395
db_VISTA Single-User DBMS by Raima	195	159
with Source Code	495	429
db_VISTA Multi-User DBMS by Raima	990	849
with Source Code	50	45
Entelekon C Function Library	130	119
Entelekon C Windows	130	119
Entelekon Superfonts for C	50	45
Entelekon Combination Package	200	179
ESP for C and Pascal	200	159
FirsTime for C by Spruce Technology	295	229
Flash-up Windows by Software Bottling of NY	75	Call
GraphiC by Scientific Endeavors	250	209
The Greenleaf Functions	185	139
Greenleaf Comm Library	185	139
The HAMMER by OES Systems	195	179
H.E.L.P. by Everest Systems	395	329
MetaWINDOWS by Metagraphics	150	139
Multi-Halo by Media Cybernetics	250	189
On-line Help from Opt-Tech Data	New	149 119
PANEL by Roundhill	295	234
PC Lint by Gimpel Software	139	109
Polytron C Library	99	79
Pre-C Lint Utility by Phoenix	395	289
Scientific Subroutine Library for C by Peerless	175	139
TopView Toolbasket by Lattice	250	199
with Source Code	500	395
View Manager for C by Blaise Computing	275	219
with Source Code	295	239
Vitamin C by Creative Programming	150	139
Windows for C by Vermont Creative Software	195	139
Windows for Data	Includes Windows for C	295 259
Zlew by Data Management Consultants	New	245 199

cross assemblers

We carry over 25 different cross assemblers from 2500 A.D.

Call us with your specific needs.

6800 XASM by 2500 AD	200	165
8080 XASM by 2500 AD	200	165
68000 XASM by 2500 AD	300	249
Z-80 XASM by 2500 AD	200	165

fortran compilers and utilities

Microsoft Fortran	Links with Microsoft C	350 229
RM/Fortran by Ryan-McFarland	595	399
ACS Time Series by Alpha Computer Service	New	495
Btrieve by SoftCraft	250	199
For-WLNs by Alpha Computer Service	New	90
ForBld-Plus by Alpha Computer Service	70	59
Multi-Halo by Media Cybernetics	Royalties	250 189
PANEL Screen Designer by Roundhill	295	234
PolyFortran Tools by Polytron	179	139
Scientific Subroutine Library by Peerless	175	139
Scientific Subroutine Package by Alpha Computer	New	295
The Statistician by Alpha Computer Service	295	269
Strings and Things by Alpha Computer Service	70	59

CIRCLE NO. 176 ON READER SERVICE CARD

for the IBM-PC / XT / AT and compatibles.

lattice products

All products in this section have Lattice serial numbers. These products receive support and updates directly from Lattice Inc., the company that actually developed the Lattice C compiler. Lattice C is in stock and ready for shipment.

Lattice C Compiler	500	Call
C Cross Reference Generator	50	39
C-Food Smorgasbord Function Library	150	109
C-Sprite Debugger	175	139
Curses Screen Manager	125	99
with Source Code	250	199
DBC dBase File Manager for C	250	199
with Source Code	500	395
LMK Make Facility	195	149
RPG II Compiler	750	595
SecretDisk Disk Security	60	49
SideTalk Resident Communications	120	95
Text Mgmt Utilities (GREP/DIFF/ED/WC/Extract/Build)	120	95
TopView Toolbasket Function Library	250	199
with Source Code	500	395

microsoft products

C Compiler	395	259
COBOL Compiler	700	495
Fortran Compiler	350	229
LISP	250	189
Macro Assembler w/utilities	150	109
Microsoft Windows	99	89
MS Sort	195	149
Pascal Compiler	300	219
QuickBASIC Compiler	99	79

other languages

Janus/ADA C Pack by R&R Software	95	89
Janus/ADA D Pack by R&R Software	900	699
Level II COBOL by Micro Focus	1500	1269
Modula-2/86 by Logitech	495	399
PCI/Forth by Laboratory Microsystems	150	119
PCI/Forth + by Laboratory Microsystems	250	209
Professional COBOL by Micro Focus	3000	2395

phoenix products

In stock and ready for immediate shipment.

Pasm86 Macro Macro Assembler	295	219
Plink-86 Overlay Linker	395	289
Pre-C Lint Utility	395	289
Pfantasy Pac	1295	995
Combination of all 6 items below		
Pfinish Performance Analyzer	395	289
Pfix-86 Plus Symbolic Debugger for Plink-86	395	289
Plink-86 Plus Overlay Linker	495	359
Pmaker Program Development Manager	195	139
Pmate Macro Text Editor	225	159
Ptel Binary File Transfer Program	195	139

polytron products

Polytron C Library	99	79
PolyFortran Tools by Polytron	179	139
PolyLibrarian Library Manager	99	79
PolyLibrarian II Library Manager	149	129
PolyMake UNIX-like Make Facility	99	79
PolyOverlay Overlay Optimizer	99	79
PolyXREF Cross Reference Utility	219	179
PolyXREF	129	109
PVCS Polytron Version Control System	395	359
PVMFM Polytron Virtual Memory File Manager	199	179

softcraft products

Btrieve ISAM File Manager	250	199
Btrieve/N for Networks	595	469
Rtrieve Report Generator for Xtrieve	85	79
Rtrieve/N Report Generator for Xtrieve/N	175	159
Xtrieve Query Utility for Btrieve	195	169
Xtrieve/N Query Utility for Btrieve/N	395	299

OPT-Tech Sort by Opt-Tech Data Processing

text editors

Brief from Solution Systems	195	Call
Epsilon by Lugaru	195	165
ESP for C and Pascal	200	159
FirsTime for C by Spruce Technology	295	229
FirsTime for MS Pascal by Spruce Technology	245	199
FirsTime for Turbo by Spruce Technology	75	69
KEDIT by Mansfield Software Group	125	109
Pmate by Phoenix	225	159
SPF/PC by Command Technology Corp	195	165

text editors

	LIST	OURS
Vedit by CompuView	150	119
Vedit Plus by CompuView	225	180
XTC Text Editor by Wenden	99	89

turbo pascal and utilities

ALICE: The Personal Pascal by Software Channels, Inc. ..	95	85
FirsTime for Turbo by Spruce Technology	75	69
Flash-up Windows by Software Bottling of NY	75	Call
Multi-Halo by Media Cybernetics	250	189
On-line Help from Opt-Tech Data	149	119
Screen Sculptor by Software Bottling	125	99
Turbo ASYNCH by Blaise Computing	100	89
Turbo EXTENDER by Power Software	85	69
Turbo Holiday Jumbo Pack	245	219
All 6 items below		
Turbo PASCAL	70	49
Turbo DATABASE TOOLBOX	55	49
Turbo EDITOR TOOLBOX	70	59
Turbo GAMEWORKS TOOLBOX	70	59
Turbo GRAPHIX TOOLBOX	55	49
Turbo TUTOR	35	29
Turbo Holiday Pack	125	99
Turbo New Pack	95	79
Turbo PASCAL by Borland International	70	49
Turbo PASCAL w/8087 or BCD	110	79
Turbo PASCAL w/8087 & BCD	125	85
Turbo POWER TOOLS by Blaise Computing	100	89
Turbo Professional by Sunny Hill Software	70	59
TurboRef by Graco Services	50	45
TurboPower Utilities by TurboPower Software	95	89
TurboWindow by MetaGraphics	50	39
XTC Text Editor by Wenden	99	89

wenden products

Operating System Toolbox	Build your own OS	99	89
PCUNIX Operating System	99	89	89
PCVMS Operating System	Similar to VAX/VMS	99	89
XTC Text Editor	Includes Pascal source code	99	89

xenix system v by sco

Xenix Development System	Specify XT or AT	495	449
Xenix Operating System	Specify XT or AT	495	449
Xenix Text Processing Package	Specify XT or AT	195	179
Complete Xenix System	Specify XT or AT	1085	969

xenix languages and utilities

APL+PLUS/UNIX System by STSC	For AT Xenix	995	795
Btrieve by SoftCraft		595	469
c-tree by FairCom		395	329
Microsoft BASIC Interpreter		350	279
Microsoft COBOL Compiler		995	795
Microsoft Fortran Compiler		495	389
Microsoft PASCAL Compiler		495	389
PANEL Screen Designer by Roundhill	For AT Xenix	595	539
Windows for C by Vermont Creative Software		395	359
Windows for Data by Vermont Creative Software		595	539

We are open until 5 p.m. Pacific Time,
(8 p.m. Eastern).

Purchase Orders are accepted from qualified accounts
at no extra charge.

Visa and MasterCard are accepted with no surcharge
applied. Please include card expiration date when
ordering by mail. Account is charged when shipped.



U.S. 1-800-336-1166



CANADA 1-800-225-1166

OHIO 1-216-877-3781

OUR NO RISK GUARANTEE

If you are not completely satisfied with your purchase
you may return it within 30 days. All returned
products must meet our standards for being in new,
resellable condition including all paperwork and
unused registration card. Products including source
code are generally excluded by the manufacturer from
this guarantee. Please ask for specific details when
placing your order.

Prices are subject to change without notice.



programmer's connection

Say goodbye to

Until now, if you wanted high speed printing, you got a dot matrix printer. If you wanted true letter quality, you got a daisy wheel. And if you wanted great graphics, you got a plotter. What you also got was an expensive and noisy hardware collection.

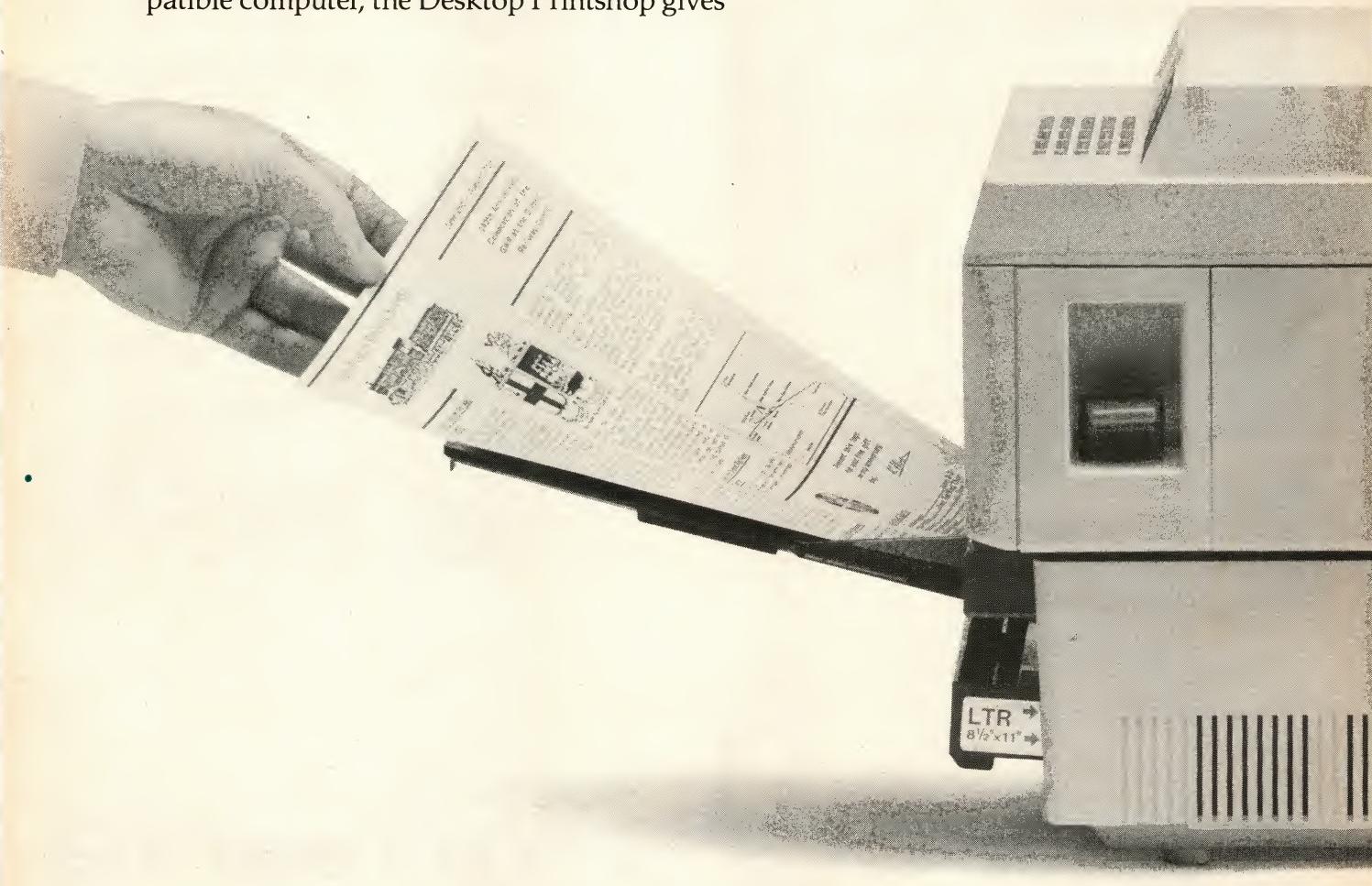
The Corona Desktop Printshop™ quietly puts an end to all that.

The Desktop Printshop prints with a whisper. No more zippety-zappety, clickety-clackety. Which means your printer can finally make friends with your office.

Coupled with an IBM-PC™ or compatible computer, the Desktop Printshop gives

you high speed (8 pages per minute), near-typeset quality printing, charts, graphs, even illustrations. And, you can mix up to 32 type fonts in a single page. Automatically. Capabilities you simply can't get with mechanical printers (Note the printout below).

The result? Communication that really communicates. Reports, newsletters, proposals, forecasts, presentations, letters, even memos that look as if they were designed by a graphic artist. The Desktop Printshop does it all. Easily. Beautifully. Quietly. Fast.



Dot and Daisy.

What's more, the Desktop Printshop offers Epson™ emulation (MX and RX). So, you have a ready-to-run solution for many programs that other laser printers simply can't use.

More good news. Unlike other laser printers, the Corona Desktop Printshop is driven by software from disks. No expensive font cartridges to load. And no problems when the technology evolves.

But seeing is believing. For a hands-on demonstration of the Corona Desktop

Printshop, call us Toll Free: 800-621-6746, (in California: 805-495-5800), for the name of your nearest Corona Dealer. Say hello to the Desktop Printshop...and it's, "Goodbye dot and daisy."



The Desktop Printshop™

CORONA DATA SYSTEMS, INC., 275 E. Hillcrest Drive, Thousand Oaks, CA 91360
TELEX 658212 CORONA WSLK; in Europe: Holland (032) 40-18111

CIRCLE NO. 103 ON READER SERVICE CARD

©1985 Corona Data Systems, Inc. Specifications subject to change without notice. PC and IBM are registered trademarks of IBM Corp.; Epson is a trademark of Epson America, Inc. Desktop Printshop is a trademark of Corona Data Systems, Inc.

 corona
data systems, inc.

News about the Microsoft Language Family

Structured programming in QuickBASIC—Part 1—Subroutines

The Microsoft® QuickBASIC Compiler provides powerful structured programming features that go far beyond BASIC's FOR/NEXT, WHILE/WEND, and GOSUB statements. True subroutines with scalar and array parameters are easy to use in QuickBASIC. All variables in subroutines are local unless they are declared as shared global variables in the current module, as shown below.

```
CALL MySort (howbig, Array())
...
SUB MySort (limit, Sieve (1)) STATIC
    SHARED bubbles
        ... 'MySort subprogram body
    END SUB
    'sort Array ()
    'Sieve is 1-dim
    'global variable
```

QuickBASIC modular programming with separate compilation and subroutine libraries will be covered in Part 2.

Interlanguage calling support added to C, FORTRAN and Pascal

The current releases of Microsoft C, FORTRAN and Pascal have been enhanced to support interlanguage calling. This was accomplished by extending the language syntax in each language and by sharing the major components of the runtime libraries—program start-up, memory models, memory allocation and floating point math support. For example, in FORTRAN these extensions allow programs to call C functions with value parameters and variable length argument lists. Under XENIX®, the interlanguage calling support allows the standard XENIX C libraries to be accessed from Microsoft FORTRAN and Pascal.

Mixed model dynamic memory allocation in Microsoft C—Part 2

During program start-up in Microsoft C, any memory beyond the 64K limit of the default data segment is released to MS-DOS®. (The amount returned can be increased by using the /CPARMAXALLOC switch to LINK or the EXEMOD utility.) This allows C programs to "exec" child programs. The first call to the near heap allocation routine, _nmalloc, creates the near heap which can use the remaining free space in the default data segment. The first call to the far heap allocation routine _fmalloc, creates the first far heap segment by requesting a block of memory from DOS rounded up to the nearest 8K (power of 2 equal or larger than the global variable _amblksiz). Subsequent _fmalloc calls will expand the last far heap segment up to 64K before allocating another far heap segment. When all far memory has been used, _fmalloc will try to allocate the memory from the near heap.

Write to: Microsoft Languages Newsletter
10700 Northup Way, Box 97200
Bellevue, WA 98009 for product and update information.

Or phone:
(800) 426-9400. In Washington State and Alaska,
call (206) 828-8088. In Canada, call (800) 387-6616.

Latest DOS Versions:

Microsoft C	3.00
Microsoft COBOL	2.10
Microsoft FORTRAN	3.31
Microsoft Macro Assembler	4.00
Microsoft Pascal	3.31
Microsoft QuickBASIC	1.00



Prototypes in Motion

Dan Bricklin's Demo Program enables designers to develop working prototypes of software built on the groundwork of a good user interface, so important in today's market.

All too often, written specifications stop short once the system's required tasks have been described in functional terms without any consideration for the face the system will present to the end user. Interface considerations often are left to the whim of the programmers on the coding team.

Simply getting the job done is no longer enough. Today software is judged on how easy it is to learn and use, how fatiguing it may be to operate for long periods of time, and simply how elegant the screens appear. These concerns cannot be addressed by trial and error. A quality user interface will reflect genuine study and work, and, presumably, testing with real users. As this aspect of development becomes dominant, developers come to realize that the nature of the user interface can strongly influence the shape of the underlying system. If user considerations are critical in marketing a software product, it makes sense to create the interface first and work backwards.

Tools designed for interface prototyping were nonexistent heretofore. Traditionally these prototypes have been produced by actually coding small portions of the program, minus their "inner workings." Besides being a lot of work, this opens the door to slapdash programming by forcing programmers to code before the whole system is fully (or even *mostly*) understood. The appearance, therefore, of an interface prototyping tool such as Dan Bricklin's Demo Program is to be applauded. *PC Tech Journal* has designated it Product of the Month for March 1986.

The Demo Program is a variation on the slide-show concept. The user designs a text screen by arranging characters and attributes on his CRT using the Demo Program's built-in editor. The screen is then compressed and stored in RAM, not as a disk file. By confining the screens to text rather than graphics, a screen can be stored in very little

memory and moved quickly into the video refresh buffer.

Commands stored with the screens can control how the screens are displayed. The order in which the screens appear can be controlled by the user. Programmable delays can be inserted between screen displays; programmable tones also are available as commands. Portions of screens can be saved as overlays for quick superimposing upon any given screen.

Using these features, a "hollow" program can be devised without doing any actual programming. Designing

PRODUCT

Dan Bricklin's Demo Program

COMPANY

Software Garden, Inc.

ADDRESS

P.O. Box 238
West Newton, MA 02165

TELEPHONE

617/332-2240

PRICE

\$74.95

could determine by survey, for example, how long of a delay is considered acceptable by users. Such data can be invaluable to the system design group in deciding just how much computation may be practical given the limits of the target hardware.

The Demo Program editor is function-key driven, with a very clean design. Rectangular blocks of text can be defined and moved, cut from one screen and pasted onto another. One keystroke copies the current screen into the following (empty) screen, making animation by successive modification of a master screen design fast and easy. Boxes can be drawn by determining a fixed and movable corner and adjusting the box size with cursor keys; boxes can be produced in any IBM ROM character. Attributes for portions of a screen can be controlled separately.

A screen-capture resident utility is provided so that "snapshots" of text screens produced by other programs may be written to disk and imported to the Demo Program editor. Furthermore, screens can be exported in two formats, one that is compatible with current practice in Pascal, and a second that is compatible with C, so that once the prototyped system is coded, the Demo Program's screens can be incorporated directly into the source code files.

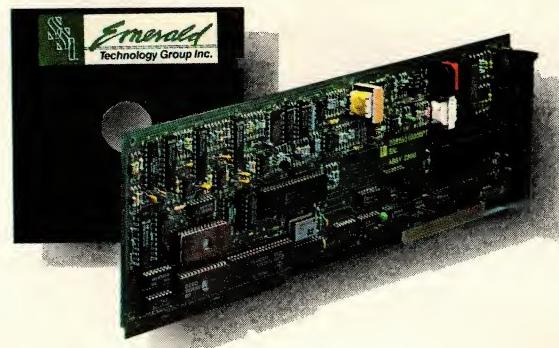
Aspects of this product do leave room for improvement, particularly the mimeographed documentation, which is copied from a dot-matrix printout. The addition of a simple command interpreter that could respond to text commands would make a simulated program much more believable, and would permit testing of the mnemonic quality of command structures. Still, remembering that Dan Bricklin invented the spreadsheet as the microcomputer world knows it, his Demo Program might be expected to become the essential tool in the neglected area of user interface prototyping.

TECH RELEASES

*Hardware, software, and other developments
for the IBM PC family*



AX/1200 and AX/2400 by Microcom



PC/5251 MATE

FROM IBM

The **IBM Virtual Machine/Personal Computer (VM/PC) Release 2** enhances the usability and performance of the PC/AT-370. New features include support for a DOS session with local and host sessions via a "hot key," APL2 character support in the local CMS session, support for the AT-370 Option Kit in the new model AT with 30MB fixed disks, and an increased number of supported IBM printers. Facilities for using the PC Network Program Redirector functions allow shared printers for high-speed or quality printed output, AT-370 CMS batch server machines, data exchange among AT-370 users, and shared files. The **VM/PC Host Server licensed program (5664-319)** for the host VM system supports communication between an AT-370 or a PC/AT with the AT-370 Option Kit installed and a VM host via a 3270 coaxial connection. It provides spool, disk, and file services; VM/PC service request processing, and support of VM/PC reader, punch, and console commands. VM/PC, \$1,150; VM/PC Host Server, \$2,000.

IBM Corporation, National Accounts Division, White Plains, NY 10604, National Marketing Division, Atlanta, GA 30327; Contact the local IBM dealer, 800/426-2468

CIRCLE 301 ON READER SERVICE CARD

HARDWARE

A lightweight, 9-track, one-half-inch magnetic tape subsystem for the PC, PC/XT, and PC/AT has been introduced by **IBEX Computer Corporation**. The **TS-100** subsystem features up to 130MB storage capacity on a 10½-inch reel and data transfer rates of as high as 160KB per second. It offers recording formats of 1,600 and 3,200 bpi that are IBM and ANSI compatible. The tape transport sys-

tem is operated by front panel controls and features self-testing diagnostics of all internal functions. \$5,950.

IBEX Computer Corporation, 20741 Marilla Street, Chatsworth, CA 91311; 818/709-8100

CIRCLE 302 ON READER SERVICE CARD

The **PC/5251 MATE** is an integrated communications facility designed to simplify communications between IBM Systems 34/6/8 and remote PCs. Developed by **Software Systems, Inc., Emerald Technology Group, Inc., and Universal Data Systems**, and marketed by **Emerald**, MATE is the first product to integrate 5251-12 terminal emulation, a synchronous modem, and an autodialer on a single PC board. It is available in two configurations. The MATE-24 includes a 2400-bps, 201C-compatible modem and is used in dial-up operations; the MATE-48 has a 4800-bps, 208A/B-compatible modem and can be used in dial-up or leased-line configurations. MATE-24, \$1,395; MATE-48, \$1,195.

Emerald Technology Group, Inc., 1601 116th NE, Suite 102, Bellevue, WA 98004, 206/462-8200

CIRCLE 303 ON READER SERVICE CARD

The **AX** family of error-correcting modems has been announced by **Microcom, Inc.** It consists of five new modems ranging in speeds from 1200 bps to 9600 bps for use over two-wire dial-up lines. Each member is Hayes and Microcom command-set compatible and each represents the announcement of three new classes of MNP (Microcom Networking Protocol) technology.

MNP class 4 modems include the **AX/1200** and **AX/2400**. They implement two new techniques to increase throughput: the adaptive packet assembly constantly monitors phone line conditions for noise and interference, and automatically adjusts data packet size accordingly; data throughput is optimized by minimizing protocol overhead. The

AX/2400c implements MNP class 5 and includes the features of class 4 plus a compression technique, providing typical throughput on text files of 4800 bps. When not in compression state, the AX/2400c is compatible with other V.22 bis and 212A modems.

MNP class 6 products include the **AX/9612c** and **AX/9624c**. These 9600-bps modems include class 4 and 5 features plus two other advancements: statistical duplexing permits adjusting the line bandwidth and data traffic flow for a maximum throughput of 19,200 bps, and universal link negotiation permits class 6 modems to connect with Bell 212A and 103, and V.22 bis modems, and then negotiate to the highest mutually acceptable speed. AX/1200, \$499; AX/2400, \$749; AX/2400c, \$899; AX/9612c, \$1,599; AX/9624c, \$1,799.

Microcom, Inc., 1400A Providence Highway, Norwood, MA 02062; 617/762-9310

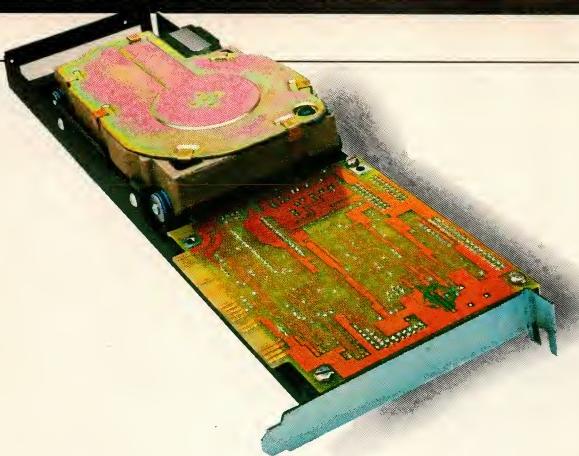
CIRCLE 314 ON READER SERVICE CARD

Four new monitors offering built-in touch capability have been announced by **MicroTouch Systems, Inc.** The line includes the standard resolution **RGB*Touch Monitor** and the high resolution **Enhanced*Touch Monitor** (both PC-compatible color displays), the **NTSC*Touch Monitor**, a color display for videodisk applications, and the

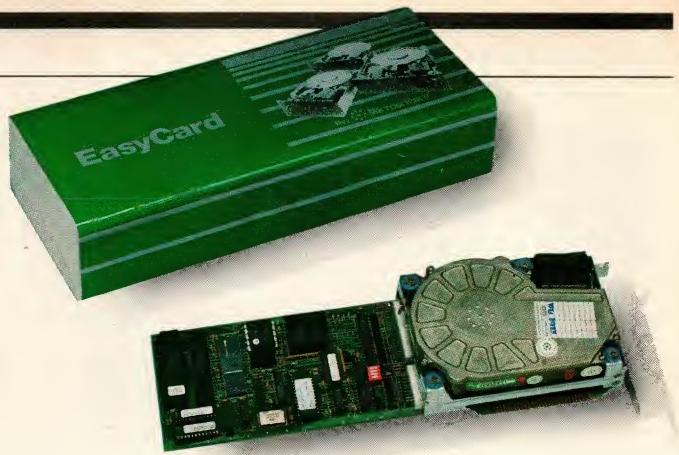
Amber*Touch Monitor, a monochrome display that accommodates both composite video and IBM-compatible TTL input. The MicroTouch screens feature a solid glass sensor with a sensitive coating bonded to the surface that senses the location of a capacitive coupling when touched by a finger or conductive stylus. RGB*Touch, \$1,695; Enhanced*Touch, \$1,995; NTSC*Touch, \$1,845; Amber*Touch, \$1,195.

MicroTouch Systems, Inc., 400 W. Cummings Park, Woburn, MA 01801; 617/935-0080

CIRCLE 319 ON READER SERVICE CARD



Tandon's DISKARD



By Microscience

A complete LAN system designed to support 10 PC-based workstations has been announced by **Nestar Systems, Inc.** Called the **PLAN 3000**, this system includes the PLAN 3000 file server; network console (CRT); Nestar's Shadow software, PLANPak, and starter library of network-licensed multiuser applications software; an integrated print server coprocessor; 10 token-passing network interface cards; and 16-port HUB. The file server provides 68MB of formatted disk storage and a 45MB streaming tape drive for backup. \$16,995.

Nestar Systems, 2585 E. Bayshore Road, Palo Alto, CA 94303; 415/493-2223

CIRCLE 316 ON READER SERVICE CARD

Several companies have introduced 20MB versions of the new disk-drive-on-a-card; the products install in any standard PC slot. From **Microscience International** comes **EasyCard**, which features easy installation, low power consumption (less than nine watts during normal operation), and its own microprocessor that tests the disk drive during power-up and makes repeated checks of the drive's performance during operation. \$1,095.

Tandon Computer Products offers the **DISKARD 21** add-in card with integral Winchester disk drive, offering 21.3MB of formatted disk capacity. Its media are plated, and it has a power consumption of 11 watts. \$995.

AK Associates has announced **HC 2045**; this drive-on-a-card has an average access time of 45 ms, a low power consumption (also less than 9 watts), and reliability features that include plated media with carbon overcoating. It removes easily for transportation and security purposes; the product is designed to withstand a 40-g nonoperational shock. Full resident diagnostics are standard. Under \$1,000 in OEM quantities.

Finally, the **DriveCard** from **Mountain Computer, Inc.**, uses 1½ card slots. The one-half slot portion fills

the nonconnector half of a full-card cage slot, leaving the connector open to accept another half card. It comes complete with Mountain's utilities software package. 20MB version, \$1,195; 10MB version, \$995.

Microscience International Corporation, 575 E. Middlefield Road, Mountain View, CA 94039-7575; 415/961-2212

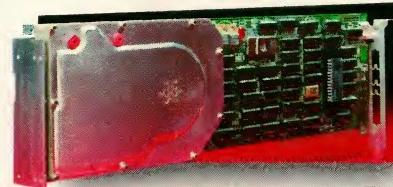
CIRCLE 308 ON READER SERVICE CARD

Tandon Corporation, 20320 Prairie Street, Chatsworth, CA 91311; 818/993-6644

CIRCLE 311 ON READER SERVICE CARD

AK Associates, P.O. Box 69, Manhattan Beach, CA 90266-0069; 213/379-9616

CIRCLE 309 ON READER SERVICE CARD



20MB HC 2045 by AK Associates

Mountain Computer, Inc., 360 El Pueblo Road, Scotts Valley, CA 95066; 800/485-0300; in California, 800/821-6066

CIRCLE 310 ON READER SERVICE CARD



By Mountain Computer

An enhancement board for the PC and PC/XT that increases processing speed by more than 300 percent has been announced by **Everett/Charles Marketing Services, Inc.** The **PC Turbocharger** replaces the 8088 with an 8086, which, combined with an increase

in the instruction clock speed from 4.77 mHz to 9.54 mHz, results in a tripling of processing speed. It includes an 8088 emulation mode for timing-sensitive programs, maintaining compatibility with all PC software. The product supports a special 8.54-mHz version of the Intel 8087-2 math coprocessor. \$1,295. *Everett/Charles Marketing Services, Inc., 6101 Cherry Avenue, Fontana, CA 92335; 800/443-1860; in California, 800/821-0589*

CIRCLE 317 ON READER SERVICE CARD

Cogent Data Technologies, Inc. has announced a board-level Winchester hard-disk controller for the PC, PC/XT, and PC/AT. The **Fixed Disk Accelerator** uses a cache algorithm with full-track, read-ahead, and overlapped data transfer to provide speed improvements for disk I/O-bound applications. The FDX is compatible with LANs, can control two hard-disk drives, and allows each disk to be partitioned into four 32MB virtual DOS drives. \$995.

Cogent Data Technologies, Inc., 175 West Street, P. O. Box 926, Friday Harbor, WA 98250; 206/378-2929

CIRCLE 312 ON READER SERVICE CARD

Racal-Vadic has introduced a high speed dial-up modem, the **9600VP**, that reduces file transfer and screen fill time. Operating at 9600 bps, with error control and data compression, the 9600VP matches full-duplex, asynchronous protocols or half-duplex, synchronous protocols. Its error and link control procedures optimize throughput on noisy lines and offer automatic originate and answer, front-panel dialing and diagnostics, software-configurable options, and support for Racal-Vadic and extended AT dialing protocol command sets. The 9600VP operates synchronously at 9600, 7200, 4800, or 1200 bps. \$1,495.

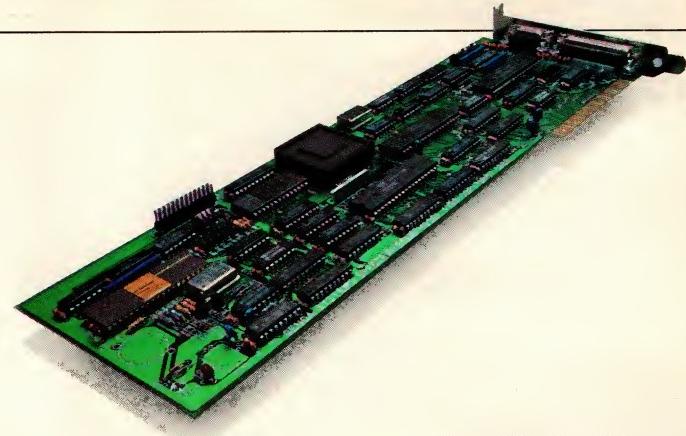
Racal-Vadic, 1525 McCarthy Blvd., Milpitas, CA 95035; 408/946-2227

CIRCLE 321 ON READER SERVICE CARD

TECH RELEASES



Planar's EL8358 M flat-panel display



Spectra-EGA by Genoa Systems

The **EL8358 M** from **Planar Systems, Inc.** is an electroluminescent flat-panel display that facilitates the use of graphics, text, and utility software created for DOS-compatible computers. The display is viewable in all ambient lighting conditions and is well suited for industrial control applications. The product's 640-by-200 pixel display provides a resolution of 83 lines per inch. Each pixel is individually addressable for a crisp display image. The unit is a complete monitor, yet only .55 inches thick and weighs only 16 ounces. \$775. *Planar Systems, Inc., 1400 N.W. Compton Drive, Beaverton, OR 97005; 503/690-1100*

CIRCLE 315 ON READER SERVICE CARD

STB Systems, Inc. has announced the **EGA Plus**, an IBM-compatible Enhanced Graphics Adapter (EGA). The EGA Plus video adapter operates in 16 different text and graphics modes. In addition to its IBM EGA compatibility, the new adapter provides 256KB of standard display memory without the need for the piggyback IBM requires. EGA Plus offers a standard parallel printer port and an optional clock/calendar. With the board, STB bundles PC Accelerator, an intelligent utility software program that provides up to 10 disk emulators and three print spoolers. EGA Plus uses available system memory, PC/AT memory above 1MB, and EMS memory (Lotus/Intel/Microsoft expanded memory specification) through STB's Memory Companion/PC board. EGA Plus, \$595. *STB System, Inc., 601 N. Glenville, Suite 125, Richardson, Texas 75081, 214/234-8750*

CIRCLE 305 ON READER SERVICE CARD



STB Systems' EGA Plus

The **Spectra-EGA** is a graphics card by **Genoa System Corporation** that supports the advanced IBM graphics standards for the PC, PC/XT, PC/AT, and compatibles. The Spectra-EGA has 640-by-350 resolution, uses a 64-color palette in any 16-color combination, and supports IBM graphics modes and products, including the monochrome/color graphics adapter, all present software, and a color monitor. It features a light-pen interface, bit-mapped graphics, loadable font, programmable cursor, parallel printer port, and 256KB of on-board memory. \$495. *Genoa Systems Corporation, 73 E. Trimble Road, San Jose, CA 95131; 408/945-9720*

CIRCLE 304 ON READER SERVICE CARD

Quadram Corporation and **Video-7, Inc.** have entered a joint development partnership to offer an IBM EGA-compatible product. The **QuadEGA+** runs all monochrome and color graphics software on the market. The QuadEGA+ carries the full EGA capacity (640-by-350 pixel resolution) in addition to IBM's color graphics adapter (320-by-200) and monochrome text display adapter (720-by-350) and the Hercules standard (720-by-348). It comes with 256KB video memory capable of displaying 16 colors from a selection of 64. \$595.

A new division of Quadram, called the **Graphics & Picture Computing Group**, in another joint venture with Video-7, has announced the **Graphics & Picture Computing System**. This fully integrated hardware and software system consists of **Palette Capture**, a printed circuit board that digitizes video input into data; **Palette Master**, a color graphics adapter that can display photographic-quality images; **Image-ware.100**, an image creator and picture editor designed to enhance pictures digitized by Palette Capture; **Imagebase**, a database system that merges pictures with data; and **Imageware Toolkit**, a

programmer's toolkit for creating customized databases integrated with photographic quality images. Picture Computing System, less than \$2,000; a turnkey workstation that includes requisite hardware and software, about \$4,000. *Quadram Corporation, One Quad Way, Norcross, GA 30093-2918; 404/923-6666*

CIRCLE 306 ON READER SERVICE CARD

Video-7, Inc., 550 Sycamore Drive, Milpitas, CA 95035; 408/943-0101

CIRCLE 307 ON READER SERVICE CARD

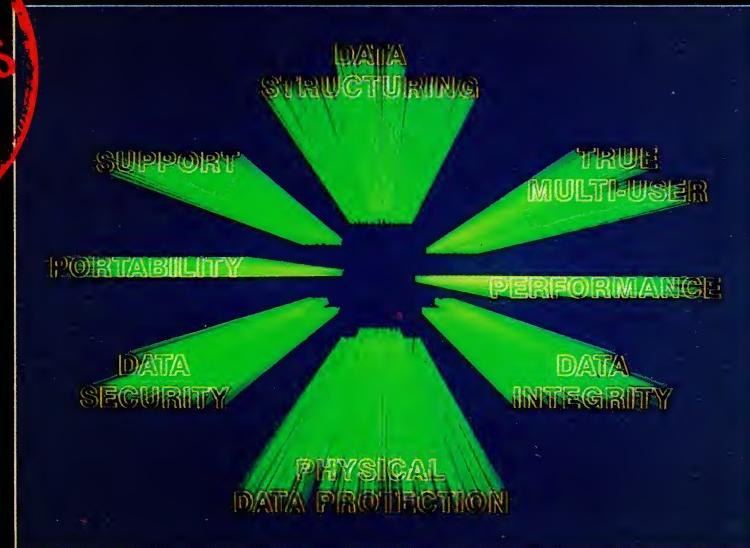


By Quadram and Video-7

Eicon Technology Corporation has announced three products designed to integrate the PC and IBM PC Network with X.25 Packet Switched Networks such as Telenet. The **Network Adapter** is a communications card with an MC 68008, 128KB of RAM, four DMA channels, and two serial ports. A standard RS-232 interface port can support full-duplex data transmission at 64 Kbps. **Attach/X.25** links PC Networks over a packet network. **Access/X.25** supports the standard X.3/X.28/X.29 interface for asynchronous start/stop terminals on public data networks. Attach/X.25 (including Network Adapter) single user, \$1,195; multiuser, \$1,395; Access/X.25 single user, \$995; multiuser, \$1,195. *Eicon Technology Corporation, 3452 Ashby Street, Montreal, Quebec, Canada H4R 2C1; 514/333-8543*

CIRCLE 318 ON READER SERVICE CARD

MDBS III[®]



... DELIVERS THESE ESSENTIAL FEATURES. DOES YOUR DBMS?

MDBS III is more powerful than most mainframe data base management systems... and less expensive. MDBS III was designed for serious application developers like you. Like the developers of Solomon III, the "Number One" accounting system. And all the others who demand these essential features MDBS III provides:

DATA STRUCTURING—So flexible it captures any data relationship you can imagine. So comprehensive you'll design complex data bases faster than ever.

TRUE MULTI-USER—Few DBMSs give you as many facilities to guard against haphazard concurrent data modification as MDBS III does, down to the locking of individual data records.

PERFORMANCE—MDBS III gives you fast data modification and retrieval plus extensive performance tuning facilities.

DATA INTEGRITY—MDBS III provides airtight integrity assurances... from range checking to transaction-logging to enforcement of data relationships... *all automatically*.

PHYSICAL DATA PROTECTION—You get automatic recovery from media as well as from physical data destruction.

DATA SECURITY—Protect your data using passwords, encryption, and read/write access down to the field level.

PORTABILITY—MDBS III runs on a range of mini and micro computers, including LANs, and supports a variety of host language interfaces.

SUPPORT—**mdbs** is there when you need us, with in-depth seminars, telephone support, individual consulting and contract programming to help you develop and install your applications.

Call us today at 800-323-3629 for more information; in Canada or Illinois, dial 312-303-6300. Or write **mdbs**, P.O. Box 248, Lafayette, IN 47902, TELEX 209147 ISE UR.

MDBS III[®]

Absolute Power

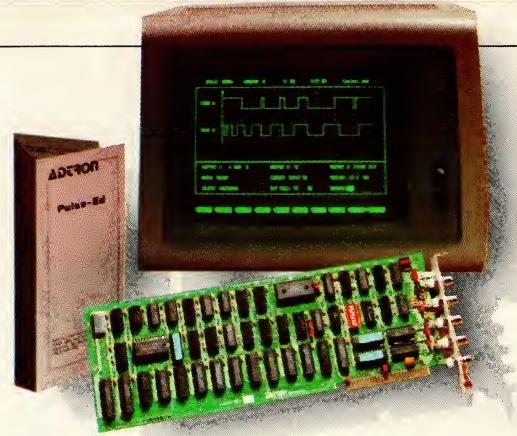
CIRCLE NO. 211 ON READER SERVICE CARD

mdbs is a registered trademark and MDBS III is a trademark of Micro Data Base Systems, Inc. IMS is a trademark of IBM. IDMS of Cullinet.





By Micro Data Base Systems, Inc.



Adtron Data Generation System

Adtron Corporation has announced its **Data Generation System**. Designed for scientists, engineers, or technicians who use digital waveform generators, the DGS consists of a data generator board and waveform editor to provide the capabilities of pattern, word, and pulse generators. Its dual-channel operation offers 32,768 bits per channel, bit widths from 50 nanoseconds to 9.999 seconds, and external sync inputs; it occupies a single IBM expansion slot. The full-screen waveform editor, Pulse-Ed, lets the user manipulate waveforms. When the board and editor are used together, the system provides realtime generation and execution of waveforms. \$2,175; quantity discounts available. *Adtron Corporation, 11415 E. Redfield Road, Chandler, AZ 85225; 602/926-1461*

CIRCLE 313 ON READER SERVICE CARD

Answer Software's ICD286 (in-circuit debugger), uses a PC, PC/XT, or PC/AT as a host and provides full speed emulation of the 80286 up to 10-mHz clock rates. The ICD286 consists of a control board, an 80286 buffer box that plugs into the 80286 socket in the target system, and a screen-oriented symbolic debugger. This basic product provides upload/download of code and data, hardware and software breakpoints, and single-step and full-speed execution of applications programs. Its REMOTE LOAD feature uses the target system to load the code and symbols into the ICD286 and greatly facilitates the debugging of applications programs on the AT. \$2,400.

Answer Software Corporation, 20863 Stevens Creek Blvd., Cupertino, CA 95014; 408/253-7515

CIRCLE 322 ON READER SERVICE CARD

The Davong MultiLink LAN is now available from **Tiara Computer Systems, Inc.** Renamed **TiaraLink**, this high-performance LAN employs proven token-

passing technology. TiaraLink offers true shared files throughout the network. Its operating system environment allows every station to function as a shared file server or to have a network printer attached. It provides three levels of security, and allows for easy expansion or modification without shutting down the entire network. Optional electronic mail software is available, as is a gateway to IBM 3274/SNA networks. TiaraLink starter kit, \$1,095; network cards, \$495; four-connector hub, \$75; eight-connector hub, \$595; software, \$500.

Tiara Computer Systems, Inc., 2685 Marine Way, Mountain View, CA 94043; 415/965-1700

CIRCLE 320 ON READER SERVICE CARD

SOFTWARE

An artificial intelligence (AI) software package for business has been announced by **Micro Data Base Systems, Inc.** **GURU** combines expert system development tools, natural language capabilities, familiar business computing tools, and four user interfaces in one program. When providing expert system consultations, GURU works with backward and forward chaining, certainty factors, and environment controls, and asks the user for additional information when necessary. GURU provides recommendations and explains its reasoning. Available for incorporation into expert systems developed with GURU are relational database management, spur-of-the-moment inquiry, spreadsheets, forms management, and statistical analysis, comprehensive mathematical capabilities, and report generation. GURU has four interfaces: natural language, menu, a direct English-like command language, and procedural programming. Single-user system, \$2,995.

Micro Data Base Systems, Inc., P.O. Box 248, Lafayette, IN 47902; 317/463-2581

CIRCLE 326 ON READER SERVICE CARD

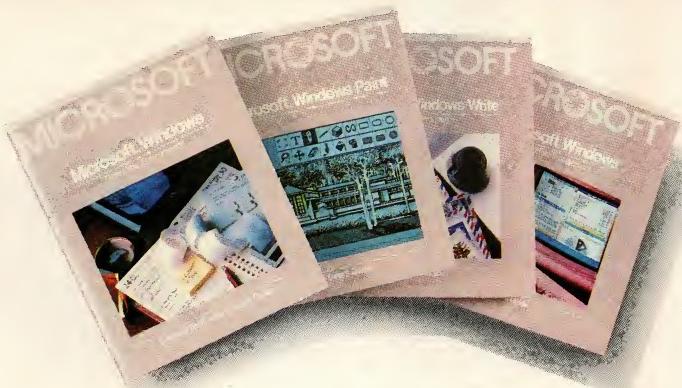
MYCROFT LABS INC. has introduced an expanded line of its MITE communications products. All of the systems were designed for CP/M-80 and MS-DOS systems. Menu-driven **MICRO-MITE** offers basic facilities to originate calls and transfer readable text. **MINI-MITE** includes password protection, preconfigured plus automatic logons, XMODEM/BATCH support, and review buffer. **MAXI-MITE** adds support for Mac systems; it offers multiprotocol asynchronous functions, including automatic dialing, automatic answering, transfer of binary and text files, and 10 programmable function keys. **MAXI-MITE+** adds a script file command language and terminal emulation to the features of MAXI-MITE. **VERTI-MITE** is specifically designed for individual industries, containing key telephone numbers; it has a quick-search facility. **MICRO-MITE**, \$49.95; **MINI-MITE**, \$95.00; **MAXI-MITE**, \$150.00; **MAXI-MITE+**, \$175.00; **VERTI-MITE**, variable price. *MYCROFT LABS INC., 2615 N. Monroe Street, Tallahassee, FL 32303; 904/385-1141*

CIRCLE 328 ON READER SERVICE CARD

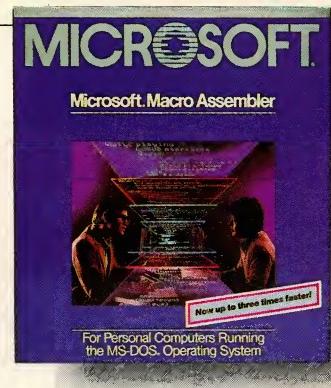
Softaid, Inc. is now shipping **MT8087**, a BASIC compiler for DOS systems with an 8087 or 80287 coprocessor. MT8087 performs real number computation 30 to 40 times faster than MTBASIC. (MTBASIC compiles in excess of 100 statements per second, so most programs will compile in a couple of seconds and then will run about 50 times faster than interpreted BASIC code.) MT8087 maintains 18 decimal digits of accuracy over a range of 10^{-308} to 10^{308} . Trig, log, and exponential functions also take advantage of the coprocessor's speed and accuracy. It supports multitasking as many as 10 BASIC programs, and makes windowing programs simple. No runtime license is required to distribute the object code. \$79.95.

Softaid, Inc., P.O. Box 2412, Columbia, MD 21045-1412; 301/792-8096

CIRCLE 327 ON READER SERVICE CARD



Microsoft Windows



Version 4.0 of Microsoft MASM

Microsoft Corporation has announced the retail shipment of **Microsoft Windows** to dealers and distributors. Windows is an operating environment that extends DOS features while remaining compatible with most existing applications already running under DOS. It lets users integrate tasks by permitting several programs to run at the same time as well as easy switching among them without quitting and restarting. \$99.

Also from Microsoft comes a new high-speed version of its Macro Assembler (MASM) language. Microsoft **Macro Assembler 4.0** is three times faster than the previous version, and its new features allow users to assemble larger source files with more symbols and more macro text. New assembly switches make the assembler more convenient and efficient. The documentation has been revised to add more programming examples and it includes the *Intel Programmer's Pocket Reference Guide*. \$150; upgrade, \$75.

Microsoft Corporation, 10700 Northup Way, P.O. Box 97200, Bellevue, WA 98004; 800/426-9400

CIRCLE 324 ON READER SERVICE CARD

BASIS Incorporated has released **BBx** (Business BASIC Extended), a multiuser, multitasking business BASIC that supports DOS, XENIX, UNIX, and networks from IBM, Microsoft, and Novell. BBx maintains portability and compatibility with existing Business BASIC programs, but adds support for windows, extended variable and function names, string arrays, STRING and DIRECTORY file types, operating system shell commands, and extended screen types, including color. It is written almost entirely in C. Single-user DOS version, \$195; IBM, Microsoft, and Novell networks version, \$495; XENIX and UNIX version, \$695.

BASIS Incorporated, 5700 Harper Drive NE, Suite 290, Albuquerque, NM 87109; 800/UX-BASIS or 505/821-4407

CIRCLE 329 ON READER SERVICE CARD

dbase III PLUS from **Ashton-Tate** is a complete database management system that combines ease of use and power with built-in multi- and single-user capabilities. Each copy of dbase III PLUS can be installed on a LAN and support one initial user. All dbase III programs and files can migrate to the LAN environment and full single-user dbase III PLUS capabilities are available. dbase III PLUS's multiuser capability includes file- and record-locking features that provide true multiuser data access without data corruption, eight levels of password protection, and high-speed encryption/decryption of data. \$695; to upgrade from dbase III, \$140.

Ashton-Tate, 10150 W. Jefferson Blvd., Culver City, CA 90230; 213/204-5570

CIRCLE 333 ON READER SERVICE CARD



dbase III PLUS screen

Borland International, Inc. entered an agreement with **IBM Corporation** under which IBM will distribute selected Borland software for IBM PC products through its National Accounts and National Marketing divisions. The first Borland products marketed in this way will be Turbo Pascal and SideKick (non-copy-protected versions). Turbo Pascal, \$69.95; SideKick, \$84.95.

Borland International, 4585 Scotts Valley Drive, Scotts Valley, CA 95066; 408/438-8400

CIRCLE 325 ON READER SERVICE CARD

IBM Corporation; Contact the local IBM dealer, 800/426-2468

CIRCLE 325 ON READER SERVICE CARD

Quinn Curtis has introduced the **General Science and Engineering Tools Package** for the Turbo Pascal programmer. It includes procedures for general statistics, multiple regression, curve fitting, integration, FFTs, file transfers to Lotus 1-2-3, solving simultaneous equations, matrix math, linear programming, data smoothing, and graphics. The **Turbo Pascal Data Acquisition and Control Tools Package** supplies procedures for analog I/O, digital I/O, thermocouple linearization, PID control, real-time graphics, and FFTs. This package uses Turbo LABLOG and Turbo HSDAS for data logging, high-speed data acquisition, and acquiring and analyzing analog data immediately. Each tool is supplied in Pascal source code format that can be compiled with either Turbo Pascal or Turbo-87 Pascal. Science and Engineering Package, \$69.95; Turbo Pascal Data Acquisition Package, \$94.95.

Quinn-Curtis, P.O. Box 10, Newton Centre, MA 02159; 617/969-9343

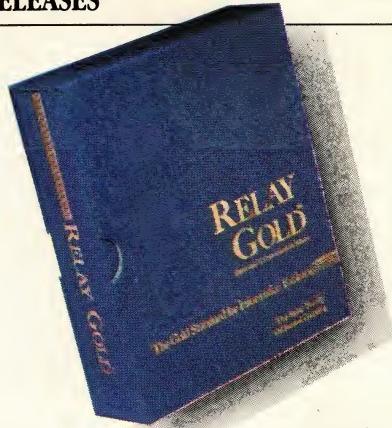
CIRCLE 331 ON READER SERVICE CARD

Version 3.0 of Epsilon, the advanced EMACS-like programmer's text editor from **Luguru Software Ltd.**, incorporates an embedded programming language called EEL, in which end users may modify and extend the editor. EEL is an interpreted implementation of C. Other improvements include support for large displays, such as IBM's Enhanced Graphics Adapter, allowance for buffer-specific key bindings, compiler-specific error packages, and a tagged regular expression search-and-replace facility, as well as other enhancements. In addition, version 3.0 retains Epsilon's concurrent process facility that allows simultaneous execution of the editor and other programmer's tools, such as compilers and linkers. \$195.

Luguru Software Ltd., 5740 Darlington Road, Pittsburgh, PA 15217; 412/421-5911

CIRCLE 332 ON READER SERVICE CARD

TECH RELEASES



From VM Personal Computing

A communications software package, **RELAY Gold**, from **VM Personal Computing Inc.**, features multitasking, a new generation script language, full menu or command-driven operation, flexible screen scrollback, a learning mode, and a tutorial diskette. **RELAY Gold** allows users to work on any DOS application program, such as Lotus 1-2-3 or WordStar, concurrent with file transfer. Its advanced file transfer protocol allows high-effective character transmission rates as well as the simultaneous swapping of files between two PCs, thus reducing telephone expenses. The **RELAY Gold Customizer's Toolbox** gives applications developers the flexibility to change **RELAY Gold**'s user interface by creating new menus or altering standard menus to fit specific needs. The Toolbox provides a display interface, advanced information on **RELAY Gold**'s script language, the ability to design and maintain screens as members in panel libraries, and scripts for controlling modems directly supported by **RELAY Gold**. **RELAY Gold**, \$225; Toolbox, \$500. **VM Personal Computing Inc.**, 6 Germantown Road, Danbury, CT 06810; 203/798-6755

CIRCLE 335 ON READER SERVICE CARD

An MS-DOS version of the **UNIFY** relational database management system has been announced by **Unify Corporation**. The product provides fast execution speeds for large databases and complex applications. It features a full set of development tools including an industry-standard SQL and a fourth generation report writer, and it is UNIX compatible. It also provides a Host Language Interface to the C language for integrating existing or custom subroutines into applications. **UNIFY**, \$995; Host Language Interface, \$495.

Unify Corporation, 4000 Kruse Way Place, Lake Oswego, OR 97034-2548; 503/635-6265

CIRCLE 338 ON READER SERVICE CARD

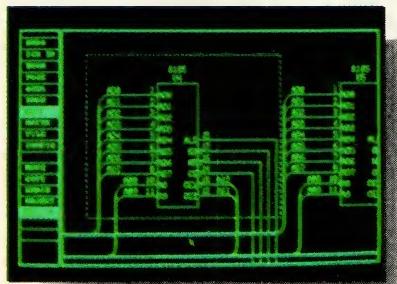


By WATCOM Products, Inc.

A new full-featured CAE schematic capture program called **SCHEMA** has been announced by **Oamation, Inc.** **SCHEMA** consists of a drawing editor with a mouse-driven user interface, extensive object libraries, and several powerful post-processors and component databases, all included in an integrated package. The drawing editor allows engineers and other professionals to generate accurate, high-resolution schematics without memorizing complex keyboard command sequences or codes. Features include realtime interaction, zooming/panning, regional editing, and command repetition. All drawing must be done with a mouse, which is not included with the package. \$495.

Oamation Inc., 1701 N. Greenville Avenue, Suite 809, Richardson, TX 75081; 214/231-5167

CIRCLE 336 ON READER SERVICE CARD



SCHEMA screen

An enhanced version of the relational data management system, **DATAEASE 2.5**, from **Software Solutions, Inc.** offers a new procedural language that requires no programming knowledge. New financial and scientific functions have been added, including support for the 8087. An encryption feature secures applications. \$600, upgrade, \$50.

Software Solutions, Inc., 12 Cambridge Drive, Trumbull, CT 06611; 800/243-5123; in Connecticut, 203/374-8000

CIRCLE 334 ON READER SERVICE CARD

UCSD Pascal and other **p-System** software products, formerly owned by Softech Microsystems, will be enhanced, marketed, and distributed by **Pecan Software Systems, Inc.** The current USCD Pascal release includes dynamic memory management, separate compilation, data-hiding, multitasking, and native code generation to enhance performance and throughput. The p-System is a development environment with facilities for creating and running applications programs. It also includes text processing capabilities and utilities for file and library management, disk recovery, and configuration. **UCSD Pascal**, \$79.95; **p-System**, \$79.95.

Pecan Software Systems, Inc., 1410 39th Street, Brooklyn, NY 11218; 718/851-3100

CIRCLE 339 ON READER SERVICE CARD

WATFOR-77, the latest member of the **WATFOR** family of FORTRAN compilers, has been released by **WATCOM Products, Inc.** **WATFOR-77** supports the full FORTRAN 77 language standard and greatly reduces the program-development cycle. A program is compiled directly into the computer's memory and then executed. One version of **WATFOR-77** requires the 8087 math coprocessor and uses the device extensively for both integer and floating-point arithmetic. A second version does not use the 8087 but provides the same level of accuracy in floating-point computations. **WATFOR-77** uses all available memory on the PC. One time license fee, \$295; annual site license fee for up to 20 PCs, \$1,200; for more than 20 PCs, \$3,000. **WATCOM Products**, 415 Phillip Street, Waterloo, Ontario, Canada N2L 3X2; 519/886-3700

CIRCLE 330 ON READER SERVICE CARD



The material that appears in Tech Releases is based on vendor-supplied information. These products have not been reviewed by the PC Tech Journal editorial staff.



Manx Aztec C86

Join The Stampede!

"A compiler that has many strengths... quite valuable for serious work"

COMPUTER LANGUAGES, 2/85

"Easily one of the fastest compilers overall... library provides a lot of flexibility... small .EXE files."

DR. DOBB'S JOURNAL, 8/85

Manx Aztec C86 - Join the Stampede!

If you are programming in C or plan to program in C for MS-DOS, PC-DOS, CP/M-86, or ROM based 8086/80x86 systems, we invite you to join the stampede to Manx Aztec C86. The stampede to the most powerful, portable, and professional C development system available for MS-DOS and CP/M-86.

Manx Aztec C86 - Power to Spare

In benchmarks published in the February, 1985 issue of Computer Languages and the August, 1985 issue of Dr. Dobb's Journal, Manx Aztec C86 again and again came up on top in benchmarks of code speed, code size, and compile times. Dr. Dobb's Journal declared Manx Aztec C86 the winner in the benchmarks, sharing the honor with the new Microsoft C compiler.

Manx Aztec C86 - Unmatched Portability

Only Manx Aztec C is available for MS-DOS, CP/M-86, Apple Macintosh, Apple II, TRS-80, CP/M-80, and Commodore systems. No other C system comes anywhere close to supporting the number of microcomputer systems that Manx supports.

Manx also provides ROM development systems for 8086/80x86, 68000, 8080/Z80, and 65xx systems.

Manx Aztec C86 - Fantastic Features

Manx Aztec C86 is heavily bundled with special features and utilities. Features described below are for the Aztec C86-c and Aztec C86-d systems. Features that are only available with Manx Aztec C86-c are marked (-c).

Optimized C compiler: Unsurpassed for code quality and speed. Optionally generates 80186 and 80286 code. Full K & R.

Symbolic Debugger: Execution trace, break points, display data in floating point, integer, character, or hex format. Evaluate expressions. Detect illegal memory stores, modify memory/registers, disassemble code.

Manx AS86 Macro Assembler: Supports macros, 8086, 80186, and 80286 instructions in Intel format. Fast execution.

LN86 Overlay Linker: Links small, large, and mixed memory model routines. Supports overlays, and options for producing ROM based code.

Librarian: Build and modify personal or system run time libraries.

8087/80287 Sensing Library: One library simulates floating point, another assumes the presence of an 8087 or 80287 math chip, the third senses the existence of a math chip, and if it finds one it uses it.

Profiler: Provides a run time analysis of your code to pinpoint code segments to optimize.

UNIX Library: Compatible with UNIX C. Fast I/O. Terminal I/O can be buffered or unbuffered.

DOS Library: Time and date functions, program forking (exec), program chaining, directory commands, I/O port support, sysint support, BIOS functions, and BDOS functions.

Screen & Graphics Library: Screen and cursor functions. Fast routines for drawing lines, circles, ellipses, points, and setting colors.

CP/M-86 Library (-c): Produce programs for CP/M-86.

Large Memory Model: Manx Aztec C86 supports programs and data of any size. Global data has a max size of 64k.

Intel Object Option: Interface to software that requires Intel object format, such as PLINK-86.

Z (vi) Source Editor (-c): Fast, powerful editor, macro capabilities, undo, ctags, buffers for commands and data, and all the bells and whistles that make vi fanatics fanatical.

ROM Support Package (-c): Startup routine, linker options for separate placement of code and data, special utilities like the Intel HEX Utility, documentation, and library source.

Library Source Code (-c): UNIX, screen, graphics, and math function libraries.

Mixed Memory Models (-c): Mix large code and small data, small code and large data, or mix within type.

UniTools (-c): The UNIX utilities make, diff, and grep.

One year of updates (-c): As new versions are released, updates are automatically sent.

Technical Support: Manx has a full time staff to provide support via telephone & bulletin board.

Aztec C86-c Commercial System \$499

Aztec C86-d Developer's System \$299

Aztec C86-p Personal System \$199

Aztec C86-z Apprentice System \$ 49

Manx Cross Development Systems

Manx Aztec C compilers are available as native or as cross development systems for PC-DOS, MS-DOS, Macintosh, CP/M-86, CP/M-80, TRSDOS, Apple II, and Commodore 64/128.

Cross development involves two computer systems: the development system (HOST) and the executive system (TARGET). This method is useful when the TARGET machine is slower or more limited than the HOST.

HOSTS: VAX UNIX (\$3000), PDP-11 UNIX (\$2000), MS-DOS (\$750), CP/M (\$750), Macintosh (\$750), CP/M-68k (\$750), XENIX (\$750).

TARGETS: MS-DOS, CP/M-86, Macintosh, CP/M-68k, CP/M-80, TRS-80 3 & 4, Apple II, Commodore C64, 8086/80x85 ROM, 68xxx ROM, 8080/8085/Z80 ROM, 65xx ROM.

Additional TARGETS are \$300 to \$500 (non VAX) or \$1000 (VAX). Call for information, on cross development to the 68000, 65816, Amiga, C128, CP/M-68K, VRTX and others.

How To Become a Manx-Aztec C User

Call 1-800-221-0440 or 1-800-832-9273 (800-TECWARE). In NJ or outside the USA call 201-530-7997. Orders can also be telexed to 4995812.

Payment can be by check, COD, American Express, VISA, Master Card, or Net 30 to qualified customers.

Orders can also be mailed to Manx Software Systems, Box 55, Shrewsbury, NJ 07701.

For More Information: call 1-800-221-0440, or 201-530-7997, or write to Manx Software Systems.

Support Software for Manx Aztec C86

Discounts are available on many items listed below. Call Manx for details.

C-tree \$395: B-tree database system. Easy to use. Available for Aztec C for MS-DOS, Macintosh, CP/M-86, CP/M-80, and others. Includes source.

PHACT \$250: Powerful database system. Available for Manx Aztec C compilers for MS-DOS, CP/M-86 and CP/M-80.

PANEL \$295: Create screens via simple, powerful editing commands. Select colors, edit fields, Directly input data to a multi-keyed file utility.

SunScreen \$99: Create and modify formatted screens easily. Validate fields, select colors, create screens for both the color and monochrome cards. With library source SunScreen is \$299.

Windows for C \$195: Versatile window utility that supports IMB PC compatible and some non-compatible environments.

HALO \$250: The ultimate C graphics package. It supports viewports, shapes, and multiple graphics cards. A less expensive version is available for just the PC mono and color cards.

FirFirst \$295: Syntax checking while you edit greatly shortens compile time.

Pre-C \$395: Powerful Lint-like utility locates structural and usage errors. Easily checks multiple files for bad parameter declarations and other interface errors. Lint users will find the user interface a dream come true.

PC-LINT \$98: Link-like utility that supports large memory models, has clear error messages, and executes quickly, has lots of options and features that you wouldn't expect at this low price.

Greenleaf Functions \$185: Source for over 200 C and assembler functions.

C Utility Library \$185: C and assembler source for screens, windows, color graphics, asynch communications, and more. The color graphics and speed of this package are impressive.

PLINK-86 \$395: MS-DOS linkage editor for producing and maintaining overlayed programs. It works with Aztec C86 in Intel object format mode.

Discounts

Discounts are available to professors, students, small businesses, and consultants. A discount is also available on a "trade in" basis for users of "brand x" C compilers. Call Manx for details.

30 Day Satisfaction Guarantee

Any Manx Aztec C system can be returned within 30 days for refund if you are not satisfied with your purchase. Only systems shipped within the USA by MANX directly to the end user are eligible for return. Refunds will not include shipping costs and a small restocking fee may be charged.

Distribution of Manx Aztec C

In the USA, Manx Software Systems is the sole and exclusive distributor of Aztec C. Any telephone or mail order sales other than through Manx are unauthorized. Manx Aztec C is sold at some retail outlets under license to Manx.

To order or for information call:

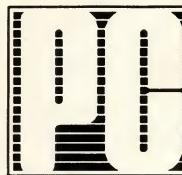
800-221-0440

UNIX is a registered TM of Bell Laboratories, Lattice TM Lattice Inc., C-tree TM Faircom, Inc., PHACT TM PHACT ASSOC., CI Optimizing C86 TM Computer Innovations, Inc., MACINTOSH, APPLE TM APPLE, INC., Pre-C, PLINK 86, TM PHOENIX, HALO TM Media Cybernetics, Inc., C-term, PC-lint TM GIMPLE Software, Windscreen, SunScreen TM SunTech, PANEL TM Roundhill Computer Systems Ltd., WINDOWS FOR C TM Creative Solutions, XENIX, MS TM MICROSOFT INC., CP/M TM DRI, AMIGA, C64, C128 TM COMMODORE Int.

CIRCLE NO. 208 ON READER SERVICE CARD

MANX

If you don't
believe advertising,
read this



PC WEEK

November 12

1985

PC WEEK

REVIEWS

'Paradox' from Ansa Software

High-Quality Database Program Is Fast, Easy

By Robert Cowart
Special to PC Week

Until now, common knowledge about database programs has dictated that buyers choose between the simpler file-management programs (such as *pfs!*) and the complex but more capable packages (like *dBASE II/III* or *R:base*), depending on their needs and level of skill. Making the jump from one level to the next, however, wasn't always so easy.

Paradox, the first market entry from Ansa Software, of Belmont, Calif., bridges this "data gap" with elegance and ease. This state-of-the-art, relational database is every bit as easy to learn and use as *I-2-3*, faster and more capable than *dBASE III*, and includes excellent documentation and tutorial material.

Finally, *Paradox* not only boasts a built-in programming language, but it also draws on artificial-intelligence techniques to provide a sophisticated and flexible reporting capability.

Installing *Paradox* took about 10 minutes with no significant incidents. Unfortunately, the program is copy-protected, but if it's any consolation, Ansa chose the Softguard protection scheme, which means *Paradox* will boot from the hard disk, without a master key disk in drive A. Also, an additional backup disk is supplied in case the hard-disk copy is damaged.

Lotus Land

Paradox's primary screen layout borrows heavily from the tabular format and context sensitive help screens of *I-2-3*, so users comfortable with *I-2-3*, *Framework* or *Symphony* will feel right at home. Users can pick from 11 menu choices across the top of the screen by simply highlighting and hitting Return, or just typing their first letter. F1 gets you help at any time. In short order, I had mastered the basics, explored a

few curious corners, and loaded in a database.

Paradox's basic mode of operation is not unlike *dBASE III*'s ASSIST mode, only markedly simplified, performing most tasks with only single keystrokes, including choosing specific files to be copied, etc. First letters of file names are often enough for *Paradox* to work with.

Databases are displayed on screen (either color or monochrome) in the form of "tables" similar to a typical spreadsheet format. Each record occupies one row, and fields are separated into columns. Columns are separated by vertical bars.

Single keystrokes move the cursor about the matrix in a manner similar to *dBASE*'s BROWSE mode, only much faster. One keystroke toggles the screen into one of several custom forms for individual record viewing and editing if you prefer, though editing can be done in the "table" screen as well by pressing F9. And, very importantly, unlike *dBASE*'s BROWSE, all changes to all records can be retracted through an "undo" command.

Reordering the display of columns, resizing columns, and rotating groups of columns is effortless, intuitive and lightning fast. Shrinking large columns down to workable size for display purposes lets you see much more data in one screen, without any data loss, and simply moving the cursor to the shrunken field and pressing a key activates a small window that can reveal all the information in this field. A key press at any time prints what's on screen for mini reports.

Aside from being very fast on screen, sophisticated virtual memory management techniques allow multiple files of almost any size to be simultaneously open, assigned a "workspace" on screen and quick-

This review is unedited. The text has been reprinted in its entirety from PC Week, November 12, 1985, ©1985 Ziff-Davis Publishing Company.

For more information and the location of the Ansa PARADOX dealer nearest you call 1-800-547-10. Ask for Department No. 10. In Oregon or outside the A. call 1-503-684-3001.

ly searched. Disk management is handled invisibly by intelligent algorithms. Pressing the F3 or F4 key moves you rapidly up or down through successive workspaces, effectively activating the database of your choice. It's almost like magic the first time you try this.

If you're a veteran *dBASE* user, you may find the idea of having countless files open a bit unsettling, but what a relief it is. What's more, *Paradox* automatically takes care of opening and closing the appropriate indexes and keeping them up to date.

Of course, getting the data out of a database is what it's all about, either on screen or on paper, and this is where most products fall flat. Great attention to detail seems to have gone into the reporting capabilities of *Paradox*.

Data extraction in *Paradox* borrows extensively upon a technique developed by Moshe Zloof of IBM in 1975 called QBE (query by example). This technique was first made available on the IBM 360 in 1978.

QBE's basic premise is to allow the user to retrieve information from the database with only a most cursory knowledge of its inner details. The user is presented with a graphical representation of an empty record in the database which he or she fills in with data exemplary of the desired results of a search. This is called a "query table" in *Paradox*.

By analyzing these entries, *Paradox* infers which information the user is looking for, and takes appropriate action, creating an "answer table" on screen to display its finding.

The user may stipulate which fields should be included in the answer table, and whether to store the answer table on disk for future use.

The same query table arrangement works for use with multiple table operations. Similar to the *dBASE III SET RELATION TO* command, multiple query tables, one for each database, may be filled in, linking several data files. The answer table can then contain information from a combination of fields of each database, for records matching all the search criteria. This is similar, though outrageously faster, than the infamous *dBASE JOIN* command. Automatic insertions and deletions from associated tables may be achieved similarly.

Imposing Constraints

A very wide variety of constraints may be imposed on data searches, including the usual mathematical operators ($<$ $>$ $=$ $+$ $-$), counts, averages, sums, dates and date calculations, wildcard character matching, soundex matching, string functions and others with a minimum of technical knowledge on the user's part. In most cases, the user is completely unaware of what indexes are open or how the query should be carried out.

Query tables remain active until intentionally erased, allowing fine tuning easily and quickly. In other words, no more re-

typing lines of cryptic code or dealing with syntax error messages.

Conducting complex queries of even a single database can call for extensive knowledge of data structures, indexes and efficient algorithms. Years of experience often go into the creation of applications with acceptable speed performance. Often, however, the result is a sacrifice in flexibility, restricting the user to limited types of data retrieval, and requiring additional programming to meet later needs. This is not the case with *Paradox*.

Paradox achieves the impossible in speed for such complex tasks as multiple joins and other complex queries by virtue of two developments from a branch of artificial-intelligence research called "machine reasoning." The developments are called program synthesis and automated problem solving.

When the user instructs *Paradox* to process a query form, the form is first translated into an executable program in *Paradox's Application Language* (PAL), similar to the code a programmer would write. Once the program or algorithm is created, *Paradox* uses a technique called "goal-oriented problem reduction" to divide the task into subtasks and sub-subtasks, if necessary.

The tasks take into consideration such factors as existing indexes, size of relations between databases, and use of temporary data at each step of the process. If *Paradox* senses that a non-existing index file would shorten the problem-solving time, it creates one "on the fly." The technology used to achieve this is similar to that used in computerized chess games.

Once an answer table is created, it may be rearranged and printed as a report. When a simple hard copy of an answer table won't suffice, *Paradox's* report generator certainly will.

With 115 pages of the user's guide devoted to reporting techniques, it's clear the folks at Ansa heard *dBASE* user's complaints loud and clear.

Paradox's reporting system uses a screen generator with superb graphics (kudos to the programmer), which easily allow placing of fields, headers and footers, calculated fields, legends, and subtotals and totals, on the page in a variety of formats. Form letters and mailing labels are also possible. A default report format is created for you, taking much of the work out of a traditionally dreary task.

Ancillary points such as setup strings for the printer, left and right margins, lines per page, and pausing for paper change are details not overlooked. Report "pages" may be up to 2,000 characters wide, with *Paradox* handling the necessary printing on consecutive pages. Then you just tape them together.

Modification of a table's data structure automatically alters all report screen forms associated with the table to reflect the changes.

The Perks

Fringe benefits worth noting include *Paradox's* import/export menu, which allows for use and creation of 1-2-3, *Symphony*, *dBASE*, *pfs:File*, *VisiCalc* and ASCII files. A "Script" function will record your keystrokes (similar to *ProKey*, *Smartkey*, etc.) for later playback.

Certainly not to be overlooked is the speed issue. As a test, I imported a mailing

list of 465 names into *Paradox* from *dBASE II* in another subdirectory on my XT. This took all of 15 seconds. Sorting on three (character) fields (multiple key sort) took another 13 seconds. In *dBASE II*, it took 2.75 minutes. This is just an example of the speed increases you can expect.

Validity checking for all types of input is also easily accomplished via a menu, at any time, even after the database is filled and structured.

In case scripting, forms files capabilities, reporting and query forms aren't enough for you, Ansa has included PAL (Paradox Application Language) with the package for applications development. This language may be used from the command line menu choice while in *Paradox*, or employed to create executable programs for later use. It is similar to the *dBASE* programming language in both name and function, but with enhancements like unlimited variables, arrays, advanced financial, trig, date and statistical functions, and DOS environment control. An integrated editor, debugger and graphical logic control simulation are included.

There are three instruction manuals available for *Paradox*, and they are intended for various levels of computer experience. All are nicely typeset, and spiral bound.

For beginners, there is an extensive tutorial, with instructions and examples included on the disks. Next, the user's guide is geared toward the experienced database user. Finally, the PAL user's guide explains the application language.

Two smaller books are geared towards *dBASE* and 1-2-3 users. Tables of contents, indexes, easy reference cards, glossaries and appendices are in evidence. The fact that I resorted to only a small fraction of the 800-plus pages of *Paradox's* various manuals is testimony to its ease of use. A customer support phone number is supplied and provided friendly assistance despite my anonymity.

Paradox's limitations on typical real world applications are few. A maximum file size of 256M bytes should pose no problems other than for hard-disk manufacturers. At 65,000, the number of allowable records per table (database) is identical to *dBASE II*, but less than *dBASE III*, which allows 1 billion.

At 255 permissible fields per record, *Paradox* ranks double the 128 field capacity of *dBASE III*, and eight times that of *dBASE II*. Fields may contain as many as 255 bytes each.

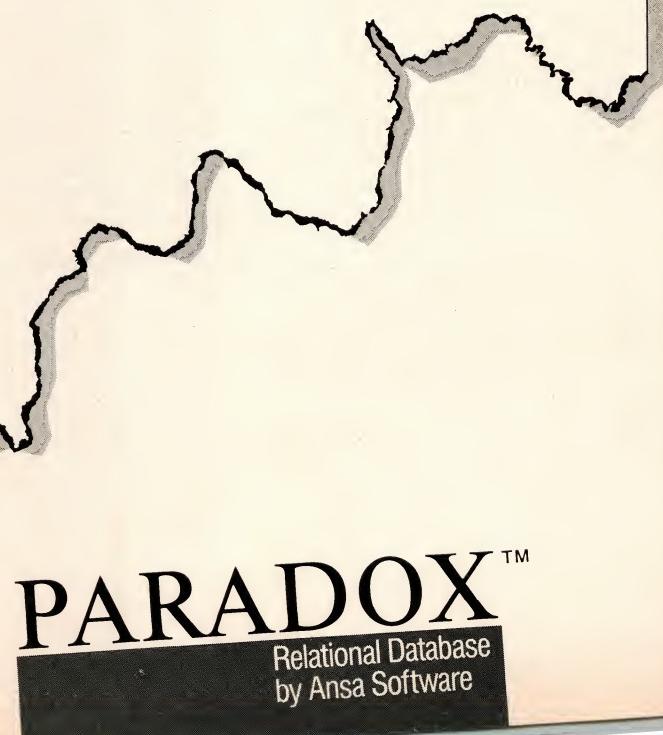
Unfortunately, *Paradox* does not have a built-in dynamically sized "memo" field for linking notes and memoranda to particular records as does *dBASE III*. Another oddity is that the number of bytes per record varies from 1,350 for indexed to 4,000 for non-indexed tables. The number of those simultaneously open is dependent upon the amount of RAM available and size of tables.

Numerical accuracy is to 15 digits, and largest number possible is 1×10 to the 308th power, which should be adequate for most purposes, except for balancing the national debt.

The conception that a small startup company can, at this point, break into the already saturated PC database market in hopes of stealing some thunder from the likes of Ashton-Tate and Microrim is a paradox whose truth rests on the quality of this product.

I'll hazard a guess based on my experience thus far, that *Paradox* will turn the market on its ear. ■

Robert Cowart is a freelance writer based in Berkeley, Calif., specializing in micro-computer technology and electronic music synthesis.



PARADOX™
Relational Database
by Ansa Software

If you want to run software with graphics on your monochrome monitor, we have some bad news.

As we're sure you've been told, the only way to run software with graphics on a monochrome monitor is to buy a graphics card.

For \$499, the Hercules Graphics Card runs these best-selling programs:

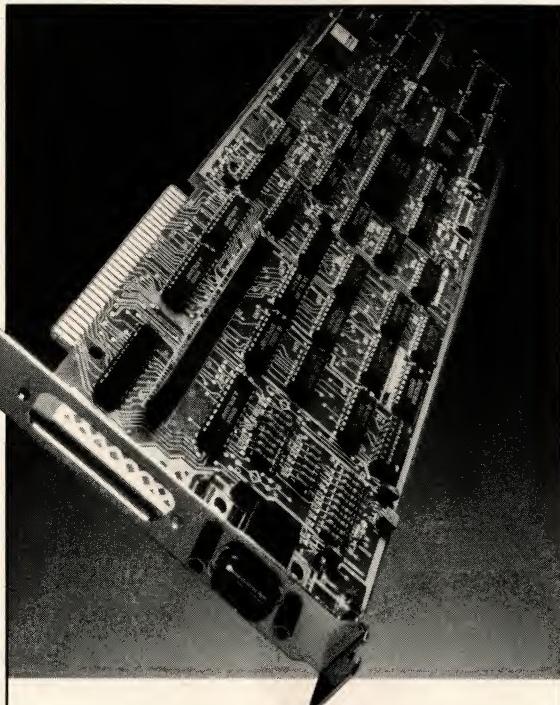
Ashton-Tate, *Framework*
BPS, *Overhead Express*
Lotus Development, *1-2-3, Symphony*
MicroSoft, *MicroSoft Flight Simulator, MicroSoft Word, MicroSoft Chart*
Software Products Int., *Open Access*
Software Publishing, *PFS: Graph*
Sorcim, *Supercalc 3*

In monochrome only.

And some good news.

For \$395, the Paradise Modular Graphics Card runs all these programs. In monochrome. And in color.

Arrays/Continental Software, *Ultra File*
Ashton-Tate, *Framework*
BPS, *Overhead Express*
Brightbill-Robert, *Graphix Partner*
Chang Labs, *GraphPlan*
Dow Jones & Co., *Dow Jones Market Analysis*
Lotus Development, *I-2-3, Symphony*
MicroPro, *Chartstar, Planstar*
MDBS, *Knowledge Manager*
MicroSoft, *Basic Compiler, Basic Interpreter, Chart, Flight Simulator, Project, Word*
PC Software of San Diego, *Executive Picture Show*
Prentice-Hall, *Execuvision*
Schuchardt Software Systems, *Intecal, Intemate, Intepert, Inteplan, Inteword*
Softrend, *Aura*
Software Products Int., *Open Access*
Software Publishing, *PFS:Graph*
Sorcim, *SuperCalc 3*
Summa Software, *Winning On Wall Street: Trader's Forecast, Winning On Wall Street: Trader's Data Manager*
Advanced Ideas, *The Game Show, Master Match, Tie Tac Show*
CBS Software, *Big Bird's Special Delivery, Dinosaur Dig, Ernie's Magic Shapes*
Davidson & Associates, *Math Blaster!, Word Attack!*
Designware, *The Grammar Examiner, Math Maze, Language Arts, Spellcopter, States & Traits, Trap-a-zoid*
Developmental Learning Materials, *Alien Addition, Alligator Mix, Demolition, Division, Dragon Mix, Meteor Multiplication, Minus Mission*
Edware, *Algebra 1, Algebra 2, Algebra 3, Algebra 4, Algebra 5*
Individual Software, *Professor Pixel, The Instructor, The Typing Instructor*
Knoware, *Knoware*
Scarborough Systems, *Mastertype, Songwriter*
Learning Co., *Addition Magician, Magic Spells, Moptown Parade, Number Stomper, Reader Rabbit*
Scholastic, *Turtle Tracks*
Sierra On-Line, *Dragon's Keep, Troll's Take*
Simon & Schuster, *Typing Tutor III*
Spinnaker Software, *Alphabet Zoo, Delta Drawing, Fraction Fever, Hey Diddle Diddle, Kids on Keys, Kindercomp, Rhymes & Riddles, Story Machine*



The Paradise Modular Graphics Card runs all the popular programs Hercules does, plus 150 more.

Springboard, *Early Games for Young Children, Make a Match, Piece of Cake Match, Quizagon*

Thoroughbred Software, *Exploring the Amazing Food Factory, The Fascinating Story of Cell Growth, How Plants Grow, Migrating Molecules, Mastering Units of Measurement, Photosynthesis*

Unicorn Software, *Funbunch, Ships Ahoy, Ten Little Robots*

Digital Research, *DR Logo*

Energetics, *Energraphics*

Fox & Geller, *dGraph, OZ*

Graphic Communication, *Graphwriter BASIC, Graphwriter Combination, Graphwriter Extension*

Harvard Associates, *PC Logo*

Innovative Software, *Fast Graphs*

Mouse Systems, *PC Paint*

PC Software of San Diego, *PC Crayon*

Peachtree Software, *Business Graphics System*

Arktronics, *Jane*

Eagle Software Publishing, *Personal Financier*

Monogram, *Dollars and Sense*

Penguin Software, *Graphics Magician*

Sierra On-Line, *Homeworld*

Adventure Enterprises, *Sea Dragon*

Atarisoft, *Centipede, Defender, Dig Dug, Donkey Kong, Pac Man, Robotron, Stargate*

Avalon Hill Game Company, *Andromeda Conquest, Computer Football Strategy, Computer Stocks & Bonds, V.C., Voyager*

Broderbund Software, *Serpentine*
CBS Software, *Match-Wits, Mystery Master: Murder by the Dozen*
Hayden Software, *Sargon III*
Innovative Design Software, *Pool 1.5*
Intelligent Statements, *Asylum*
Microlab, *Crisis Mountain, Death in the Caribbean, Dino Eggs, High Rise, Miner 2049er*
Muse Software, *Castle Wolfenstein*
Odesta, *Backgammon, Checkers, Chess, Odin*
Origin Systems, *Ultima III*
Orion Software, *J-Bird*
PC Software of San Diego, *Championship Blackjack*
Penguin Software, *The Quest*
Priority Software, *Forbidden Quest*
Scarborough Systems, *Buck Rogers, Congo Bongo, Star Trek*
Sentient Software, *Cyborg*
Sierra On-Line, *BC's Quest of Tires, Championship Boxing, CrossFire, Dark Crystal, Frogger, King's Quest, Oil Well, Ultima II, Ulysses and the Golden Fleece*
Sir Tech, *Wizardry*
Sirius Software, *Buzzard Bait*
Spectrum Holobyte, *Gato*
Spinnaker Software, *Snooper Troops #1, Snooper #2*
Sublogic, *"Night Mission" Pinball*

It's true, Hercules only runs 10 of the 161 programs with graphics for the IBM PC carried by SOFTSEL®, the largest distributor of micro computer products.

Since the Paradise Modular Graphics card is 100% compatible with the IBM color graphics standard, it'll run virtually every program written for the PC. In monochrome. And in color. Now and in the future.

And we give you a \$50 trade-in allowance on your old Hercules or IBM card.

So see your dealer or call us. And get some good news for a change.

PARADISE

S Y S T E M S , I N C

CIRCLE NO. 230 ON READER SERVICE CARD

C Programmers: Here are 7 ways You can be more productive

Dear Microcomputer Programmer,

Let me tell you how you can find and choose the best development software for your needs — software that will help you:

- * Speed your development efforts
- * Write even better programs

- * Increase productivity
- * Reduce your programming frustration

All you have to do is consider one of these seven products for C programmers (or the 97 other C compilers, interpreters, support libraries, debuggers, or addons we offer). Then call one of our knowledgeable consultants - toll free - for details, comparisons, or for our specially prepared packets on C, C Libraries, or C Productivity Tools.

There is no obligation. You risk nothing with our moneyback guarantee of satisfaction.

Yours for more productive programming,

— Bruce W. Lynch, President

Even for Small Files: Convenient, Fast Access

CBTREE™— Only \$99

Why spend time writing file management code when you can use consistent, flexible, documented, professional function? Even multiuser record locking and variable-length records are supported.

Full, balanced Btree support includes use of multiple keys, unlimited number and length of keys.

Use this powerful ISAM, even if you've previously done without.

Learn how to write systems for managing large files by using CBTREE source as a guide. Modify it and transfer it to another operating environment without royalties.

Why Lattice C™? From Lifeboat Associates

Trade mags such as Byte and PC Tech have nearly outdone themselves in praising Lattice C's speed and compactness.

With compilers for the Amiga, Z80, 370, 8086, plus cross tools, Lattice C is the standard. More support products than any other compiler make "reinventing" unnecessary.

Lattice C is a full implementation of K&R. It is compatible with any 8086 or 8088 and now has a 286 compile option.

Seven different memory models enable you to select the appropriate combination of addressability & efficiency to suit a particular situation.

Other specs include automatic sensing of an 8087 chip; Fork function; and complete I/O routines.

MSDOS \$289

Get File Access with TIGHTER Control db_VISTA™ Data Management

Full source, no royalties and "normal" indexed file management are part of db_VISTA. Get more for the price of only an ISAM.

You can minimize data stored and access records even faster and more logically than just using indexes. Example: address and transaction data should not require redundant storage of customer names or numbers. Use pointers. Related data fields point to other related groups - the "network model" of data.

Use db_VISTA as a "normal ISAM" or save programming time, access time and file size. Lattice, C86, Williams, Desmet, Microsoft C.

MSDOS Multiuser source \$995, Object \$495

Single user source \$450, Object \$169

Unix, Xenix, & Macintosh versions also available. Call for details.

SORT/MERGE Files for Clean, Fast Maintenance

with OPT-TECH SORT™

Performance should not suffer with DOS or other "free" sorts. ISAMs alone are slow when 10% or even less is changed/added.

OPT-TECH includes:

- CALLable and Standalone use
- C, ASM, BAS, PAS, FTN, COBOL
- Variable and fixed length
- 1 to 9 fields to sort/merge
- Autoselect of RAM or disk
- Options: dBASE, BTrieve files
- 1 to 10 files input
- No software max for # Records
- All common field types
- By pass headers, limit sort
- Inplace sort option
- Output = Record or keys

Try what you're using on an XT: 1,000 128 byte records, 10 byte key in 33 seconds. MSDOS \$85

Fast File Access with Source Variable Length Fields Save Space

CIndex™ ISAM Product Line

C-Index contains a high performance ISAM, balanced B + Tree indexing system and variable length fields. The result is a complete data storage system to eliminate tedious programming and add efficient performance to your programs.

Features include random and sequential data access, virtual memory buffering, and multiple key indexes.

With no royalties for programs you distribute, full source code, and variable length fields C-Index/Plus fits what you are likely to need.

Save time and enhance your programs with C-Index/Plus. MSDOS \$349. With C-Index/File for \$89, or/Pro for \$179.

Make REAL TIME Programming Practical Csharp Realtime Toolkit™

Data acquisition, process control, robotics and devices monitoring applications become practical with Csharp!

Full source code helps tailor programs to various boards and applications.

Reentrant, interrupt handling routines help schedule and react. Fast graphics routines help visualize what is happening.

Control multiple ports reliably, schedule tasks based on events, manage priorities — all with modular, tested, and reliable routines.

Assess and manage the state of hardware at the object level. Let Csharp handle the details.

Portable C source.

MSDOS \$600

THE PROGRAMMER'S SHOP

128 Rockland Street
Hanover, Massachusetts 02339

800-421-8006

In Mass. 800-442-8070 617-826-7531

If you call for our advice, you must be completely satisfied with the product you purchase from The Programmer's Shop. If not, you will receive a refund or replacement. Call now for details or our new catalog.

57

Accelerating 2.1

The head settle time in DOS 2.1 can be speeded up to match the faster times of versions 1.1 and 2.0.

Different versions of DOS have different values for *head settle time*. After seeking from one track to another, diskette drive heads tend to oscillate before they stabilize enough to be able to read or write data.

In DOS 1.0, the head settle time default is 25 milliseconds. For DOS 1.1 and 2.0, this default is corrected to 0, which is one reason that these later versions run faster than 1.0. Upon introducing half-height drive support in DOS 2.1, this default inflated to 15 milliseconds.

The patches presented below can reduce head settle time in 2.1. The FORMAT feature exhibits the most noticeable difference. A FORMAT of a double-sided, nine-sector diskette normally runs 65 seconds under DOS 2.1, but with the patches it takes 41 seconds.

Tests on PCjr and PC Portable show no problems using the faster parameters (the reason given for the increase in head settle time in DOS 2.1 was to accommodate the half-height drives of PCjr and the Portable).

To customize DOS 2.1 so it will run at the speed of versions 1.1 and 2.0, the reset diskette default parameters must be modified. They are contained in four locations: one in the bootstrap, two in the hidden file IBMBIO.COM, and one in the FORMAT command. The bootstrap parameters are in control momentarily at boot time. The IBMBIO.COM parameters are in control most of the time. The FORMAT.COM param-

eters are simply placed in the bootstrap of diskettes that are formatted; changing FORMAT.COM is a convenient way to implement the faster parameters for all diskettes to be formatted in the future, without having to run DEBUG for each one.

With the patches, all disks formatted from the customized diskette or hard disk will have the faster parameters. A hard disk must have a single partition. All disk drives have a finite head settle time. The implementation of these modifications may cause data to be sent to the disk drive before the drive is ready. Most applications successfully perform a retry not visible to the user. The critical value for the head settle time is 0. Changes up to 65 milliseconds do not significantly alter the time required to format a diskette.

To accomplish this customization, insert a double-sided boot diskette in drive A: or a hard disk in drive C:. Use DEBUG to change the head settle time defaults, as shown below. (Comments are shown in parentheses.)

These same modifications cannot be made with DOS 3.1 as the bootstrap, because IBMBIO.COM and FORMAT.COM do not have the same string of instructions that reset the diskette default parameters.



Robin Rodabaugh is vice president of computer services for a large life insurance company. He has 18 years experience with IBM mainframe and PC operating systems; he has a degree in mathematics.

FIGURE: DEBUG Sessions to Patch 2.1

```

FOR BOOTSTRAP:
A>DEBUG (Run DEBUG.)
-L 100 0 0 1 (Read in the bootstrap.)
  (If patching a hard disk, use
  "L 100 2 0 1".)
-D 100 (Confirm that location 12A contains
  OF02CD19H.)
-E 12A 00 (Change 15 milliseconds to zero.)
-D 100 (Confirm that location 12A contains 00H.)
-W 100 0 0 1 (Write out the modified bootstrap.)
  (If patching a hard disk, use
  "W 100 2 0 1".)
-Q (Exit DEBUG.)
```



```

FOR IBMBIO.COM:
A>DEBUG (Run DEBUG.)
-L 100 0 F 1 (Read in sector 4 of IBMBIO.COM.)
  (If patching a hard disk, use
  "L 100 2 34 1".)
-D 100 (Confirm that location 177 contains
  OF9C1E50H.)
-E 177 00 (Change 15 milliseconds to zero.)
-D 100 (Confirm that location 177 contains
  00H.)
```

```

-W 100 0 F 1 (Write out sector 4 of IBMBIO.COM.)
  (If patching a hard disk, use
  "W 100 2 34 1".)
-L 100 0 10 1 (Read in sector 5 of IBMBIO.COM.)
  (If patching a hard disk, use
  "L 100 2 35 1".)
-D 100 (Confirm that location 154 contains
  OFABB002H.)
-E 154 00 (Change 15 milliseconds to zero.)
-D 100 (Confirm that location 154 contains
  00H.)
-W 100 0 10 1 (Write out sector 5 of IBMBIO.COM.)
  (If patching a hard disk, use
  "W 100 2 35 1".)
-Q (Exit DEBUG.)
```

```

FOR FORMAT.COM:
A>DEBUG (Run DEBUG.)
-N FORMAT.COM (Name FORMAT.COM as the target file.)
-L (Read in FORMAT.COM.)
-D 1A00 (Confirm that location 1A22 contains
  OF02CD19H.)
-E 1A22 00 (Change 15 milliseconds to zero.)
-D 1A00 (Confirm that location 1A22 contains
  00H.)
-W (Write out the modified FORMAT.COM.)
-Q (Exit DEBUG.)
```

These sessions show the sequence of commands for the modifications to the bootstrap, IBMBIO.COM, and FORMAT.COM.

Ensuring Data Integrity

The techniques for the generation of duplicate file handles outlined here can protect against loss of data in RAM.

Power surges can cause severe problems if they occur while a data file is being created. After the system is rebooted, the user discovers that all data in RAM were lost and all open files were left open.

Consider, as an example, an order entry application, which is made up of customer files, inventory files, and order files, and which supports a number of access paths, or indexes, to those files. All of the system activity is related in some way to access of the database, and, as a result, all primary files are opened when the system is booted. Further, all of these files remain open until the end of operations.

A large number of buffers assigned in the CONFIG.SYS file can produce performance advantages for multi-file processing applications running in DOS, such as the order entry example that was mentioned above. However, even when only the minimum number of buffers is assigned, DOS writes data back to disk only when the data required are not already stored in RAM and when no empty buffers are available. Consequently, an increase in the number of buffers that are assigned in the CONFIG.SYS file simply increases the amount of data that are stored in volatile memory.

When a new customer record is added to the order entry file in the example, the indexes are updated for the customer file, an entry is added automatically to the order file, and, finally, the index of the order file also is updated. However, this new information is not written back immediately to the actual file; instead, DOS retains it in memory buffers. Similarly, if the addition of this record has forced the allocation of a new cluster, this information is stored only in the memory-resident FAT, not on disk. Neither the size nor the content of the actual file is altered.

If a break in power occurs before all of the new data are written to the disk, they, along with any other data stored only in the memory buffers, are lost.

Data are passed from buffer to disk either when a buffer is required for new data or when DOS flushes all the buffers at the request of the user. A flush of all the buffers can be accomplished with function call 00H (program terminate) or function call 0DH (disk reset). The buffers for a specific file can be flushed with function call 10H (close file) or function call 3EH (close a file handle).

Suppose a new customer record is added in the order entry file that forces the allocation of a new cluster. Updates are made in the FAT, and, as the result of subsequent I/O, are forced out to disk. The new record also may be written to the disk; however, the key in this case is not the record but the directory. If the file is not closed and a break in power occurs, the directory may not be written back to disk.

When the system is rebooted, both an incorrect FAT and directory exists for that open file. The FAT points to a record

that is outside the allocation of the master file. The record may have been written, but when the user attempts to access it an I/O failure occurs. The FAT says the record is present, but the file is unable to locate it. If the FAT made it to disk before the break in power, a CHDKSK with the /F parameter in DOS will correct the problem. This, however, can be discovered only through trial and error.

This kind of problem is inherent in any on-line system environment. Each separate applications system, or short job, within the environment remains in the memory buffer only as long as actual processing is taking place, and file integrity is fully restored each time that the file is closed. However, in such an environment, database files typically are not closed until the termination of the entire system at the end of each day. As a result, the data stored in memory buffers remain unprotected and vulnerable until closure of database files.

One solution to this problem is to close a file immediately after it has been updated. This, however, necessitates reopening the file for each use. DOS is reasonably quick when closing a file, but can be excruciatingly slow when opening one because of the directory search it must perform in order to find the file to be opened.

Another solution that reduces the chances of data loss involves generating duplicate file handles using INT 45H (mnemonic DUP). DOS maintains the file control block (FCB) in memory and provides a handle that can be used to read, write, or close a file. DUP provides that, when an existing handle is placed in the BX register and a call is made, DOS returns a duplicate handle for that file in the AX register.

Each time that a file is updated, the user can create a duplicate file handle and use it to close the file. The records, the FAT, and the directory entry for that file are all written from memory safely back to disk. Moreover, the user does not need to reopen the file after the file information has been forced out to disk because the original file with the original file handle is already open—it was never closed. The seek pointer for this original file has remained intact.

Detecting the state of the buffers for a program under execution on a PC is difficult. However, if a compiler uses DOS calls and file handles, this technique works as outlined. Unfortunately, most compilers currently use FCBs to the exclusion of file handles; they are intended for use with DOS versions 2.0 and earlier, which do not employ file handles.

This method of data protection is not foolproof. Data still can be lost in the interval existing between the start of a file update and the pseudo file close.

Dan Daetwyler, now retired, worked for 20 years as a systems architect with IBM. He received his bachelor of science degree in physics from Kansas State University at Pittsburgh, Kansas.

Upward Mobility

ADVANCED LOGIC RESEARCH

XT—ALR'S MOST POPULAR SYSTEM

On the Advanced XT Turbo System, ALR has installed all the features leaving little need for add-ons.

The Advanced XT System has a 65% faster CPU, with 640K RAM and a 20 megabyte hard disk. Parallel, serial and clock calendar ports are all standard. The swivel and tilt monitor and video controller provide sharp characters plus 720 x 350 graphics.



AT—THE ALR SYSTEM 286

The ALR System 286 is based on the advanced 80286-8 16 bit microprocessor with a system clock rate of 8MHz. This performance results in running most IBM PC or XT software up to 350% faster: In seconds you'll be able to recalculate large spreadsheets and instantly load files.

THE DEAL:
\$6,995

To help you start your network system, ALR has packaged a powerful AT Tower, with two turbo XT workstations all networked and ready to perform.



SPECIFICATIONS—IBM PC AT Compatible, 80286-8 MHz CPU, 1 Mb RAM, opt 2 Mb RAM (On Board), 1.2 Mb Floppy, 30 Mb Hard Disk (FAST 40 MS Access) Printer Port (On Board), Dual Network Port (On Board), 720 x 350 Mono. Graphics, 83 Key Keyboard, 6 Unused Expansion Slots.

IBM is a registered trademark of IBM Corporation.

Xenix is a registered trademark of Microsoft Corporation.

ADVANCED LOGIC RESEARCH—ALR

At ALR our systems all have UPWARD MOBILITY built in. We start by designing the maximum flexibility in our advanced main system boards, resulting in more valuable expansion slots left free for your future growth. ALR's years of expertise in providing demanding OEM's with IBM compatible systems results in outstanding products for all phases of your growing business.

THE AT TOWER—Big System Performance—The AT Tower gives you the best return on your hardware investment. Its floor standing package provides up to 4 full height drive subsystems to meet the most demanding requirements.

The heart of the AT Tower is an advanced IBM PC AT compatible computer with 33% more processing speed, 33% more hard disk storage and four times more RAM memory than the IBM's most powerful PC.

THE NETWORK—ALR STAR NET—Make It Simple—The ALR Star Net uses the low cost, quick connect telephone cords (RJ11) to link ALR XT workstations or IBM PCs to the resources of the AT Tower.

The ALR Star Net's local hook-up can be an incredible 1,000 feet and remote networking with modem support can be across the country. Software support of the Star Net provides you with the security of passwords and user ID, along with priority network access to maintain full control of resource sharing.

ADVANCED LOGIC RESEARCH, INC.

2991 E. WHITE STAR AVE.

ANAHEIM, CA 92806

(714) 666-2951

AIR

CIRCLE 116 ON READER SERVICE CARD

Elusive Acquisition

Some high-frequency AC signals are difficult to capture with a data acquisition board; the circuit discussed here helps to provide a solution.

A data acquisition board can work great when measuring DC or low frequency AC signals. But what happens when it is needed to measure AC amplitude at frequencies of as high as 500 KHz? The sampling frequency of several million samples per second cannot be obtained directly. The signal preconditioning circuit described here is one method of overcoming this problem.

This circuit determines the RMS value of the AC waveform and converts it to a DC voltage that can be handled by the analog input channel on the data acquisition board. (Remember, not all AC waveforms are sinusoidal.) The root mean square converter calculates the equivalent DC voltage for the AC input. This voltage is derived from the square root of the mean of the square of the supplied AC voltage.

The figure shows one way to achieve this. Switch S1 permits a choice of AC or DC coupling. Diodes D1 and D2 and resistor R3 provide input amplifier protection. U1 is a National Semiconductor LF411, selected for its bandwidth and low input bias current. The offset voltage may be adjusted to near zero by the variable resistor Rvos. Switch S2 permits operating U1 as a buffer or a gain stage.

Note that R2 sets overall circuit gain. The values shown yield a gain of 10. High voltages (greater than 10v RMS) can be handled by an input attenuator, or by configuring U1 in an inverting amplifier mode with fractional gain.

The output of U1 drives an Analog Devices AD536A TRMS (True Root Mean Square) converter. The values shown give low ripple down to 60 Hz. Capacitors C_a, C₂, and C₃ must be increased for lower frequencies to keep the ripple voltage to a manageable size. The output of the 536A can directly drive an analog input on a data acquisition board. Set this analog channel for a range of 0 to 10 volts.

The circuit's gain and offset may be adjusted by first shorting the input and adjusting R_{vos} for zero output. Next, the gain can be trimmed by applying a known amplitude 1 KHz signal to the input, and adjusting R₂ until the output gives the correct TRMS voltage.

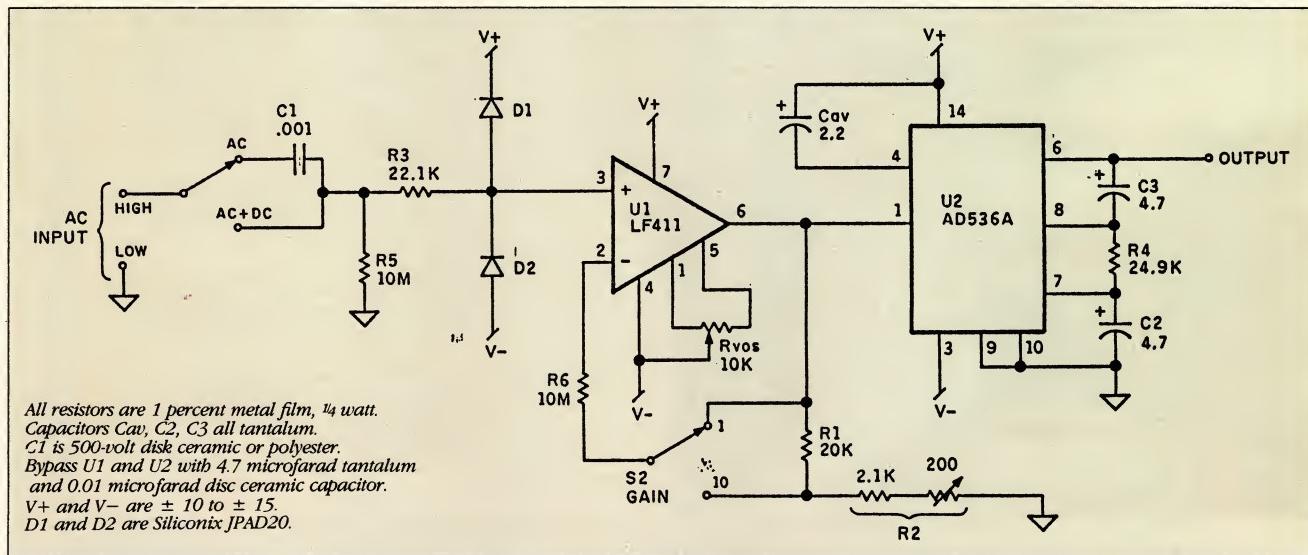
Remember that a circuit such as this should not be connected directly to the AC power line because 99 percent of all data acquisition cards do not isolate their inputs from the computer's ground. A method of measuring the power line voltage would be to use an isolation transformer such as a 6.3-volt filament transformer.

AC current measurement can be done using a current probe in a typical fashion; simply connect the probe to the input of the preconditioning circuit.



Eric M. Miller is president of Miller Technology, Inc., a firm that specializes in analog-to-digital hardware/software systems. He earned a master's degree in electrical engineering from Purdue University.

FIGURE: Signal Preconditioning Circuit



This preconditioning circuit enables AC voltage waveforms outside the specified range of the data acquisition board to be analyzed by first converting the waveform to its DC equivalent and then injecting this equivalent waveform into the board.

Get up to speed for under a hundred bucks.

If you're writing in the BASIC that came with your IBM® PC, now you can make your programs scream. Microsoft's new QuickBASIC Compiler will punch you right into warp speed, accelerating your programs by as much as ten times. And all with hardly any code changes.

You get all this at a price that won't slow you down, either. Just \$99 and you're in.

The new QuickBASIC Compiler was designed to work with the



programs you've already written. It supports all BASIC sound and graphic statements including PLAY, SOUND, LOCATE, DRAW, GET, PUT, LINE,

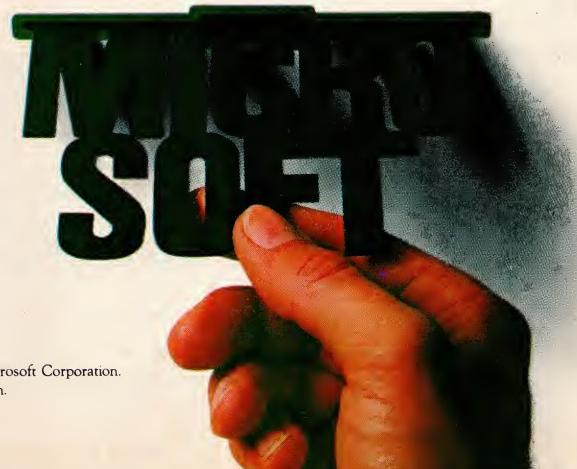
CIRCLE, PSET, and COLOR.

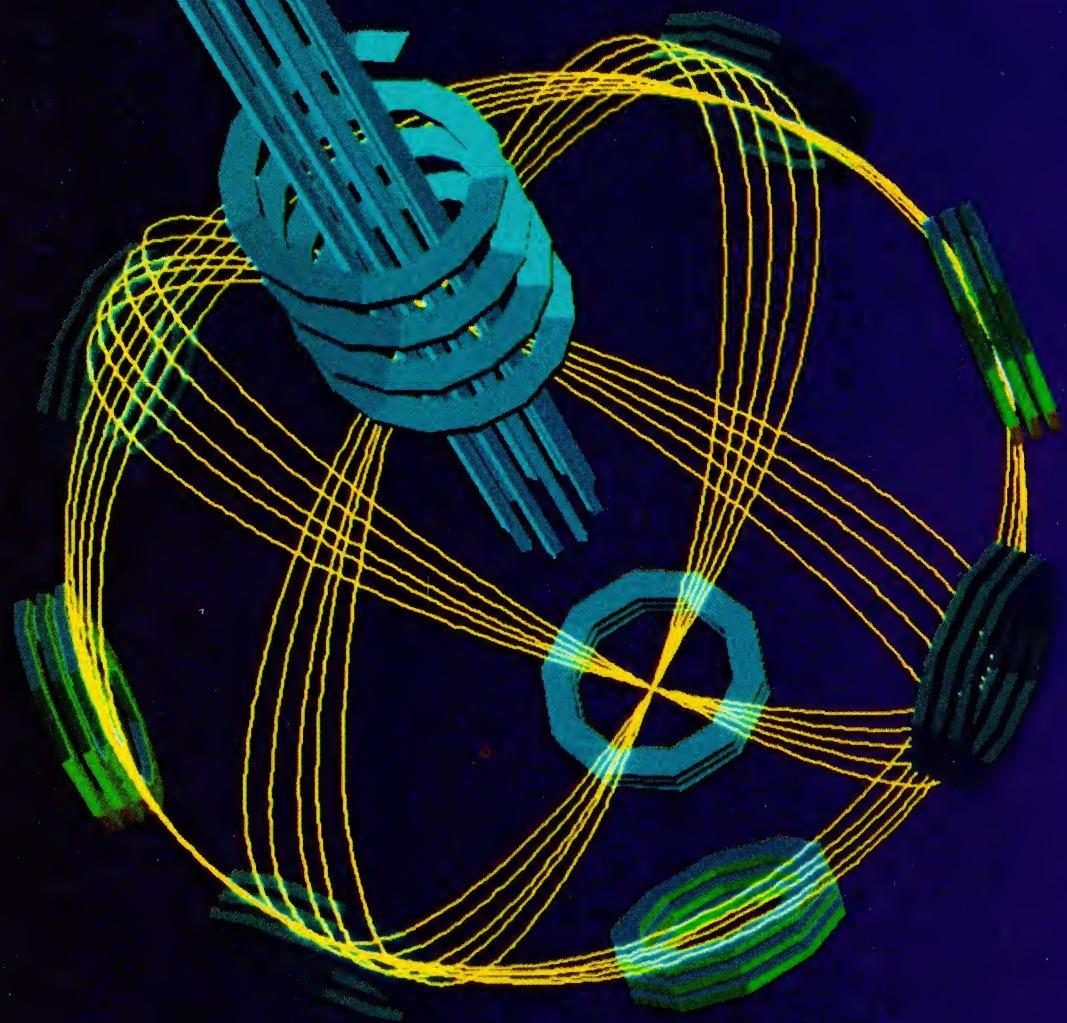
So your graphics and music routines will look and sound as they should.

And when you're ready to move into structured programming, QuickBASIC also offers language extensions for a speedy transition. With optional alphanumeric labels you can make your programs more readable. And compiled subprograms will save you time.

So get moving. Call us now for more information on the QuickBASIC Compiler and the name of your nearest Microsoft dealer. Just ring (800) 426-9400. In Washington State, Alaska, Hawaii and Canada, call (206) 828-8088.

Then go give your programs a swift kick.







REALTIME SYSTEMS

Multitasking Methods

The PC family now has the power to handle multitasking systems with realtime applications. This series of articles begins with a look at minimal multitasking packages that coexist with DOS.

RICHARD M. FOARD

This is the first in a series of articles about multitasking operating systems that can be used in realtime applications. The series begins with a discussion of multitasking basics, an example of multitasking in its simplest form, and a review of a commercial subroutine package for PC multitasking. Proceeding from the plain to the fancy, subsequent articles will review commercial multitasking environments, first examining cooperating systems that run under DOS, then presenting a number of full-fledged, stand-alone multitasking operating systems. Products examined will be limited to those useful to developers building PC-based realtime or transaction processing systems.

Since the dawn of computing, computers have been doomed to deal with objects much slower than they are. Even the earliest computers swallowed and spat data faster than the printers, card readers, tape drives, and disks that surrounded them. Because nearly all programs needed to use inherently slow input and output devices, the fabulously expensive new computing machines often spent more time idling than they spent computing.

The obvious solution to the problem—running several programs concurrently so that when one had to wait for something, another could do useful work—first appeared in the 1960s in the form of *multiprogramming*, or

MULTITASKING

batch, operating systems for mainframe computers. These load and run many programs at once, creating the appearance that each had a machine to itself.

As computers were put to new tasks, the techniques used in batch operating systems found application in other settings. The first time-sharing systems were multiprogramming systems like their batch predecessors, but met the additional requirements of responsiveness and fairness. A batch system made efficient use of machine resources, while time-sharing systems went one step further to ensure that no individual program waited too long for its turn at the processor.

Transaction processing systems, such as the pioneering SABRE airline reservation system, emerged and, like time-sharing systems, had to perform many functions concurrently while providing timely service to many users. They also brought with them another layer of requirements. Whereas the programs on time-sharing computers were independent competitors for processor time, the programs making up transaction processing systems had additional responsibilities to perform. They needed to cooperate with each other to pass information back and forth, manage a shared database, and retain enough checkpointing information to enable quick, reliable failure recovery.

Another area in which concurrent processing techniques were put to use was realtime systems. Characterized by an ability to respond quickly to events occurring outside the computer, realtime systems found application in industrial instruments, process control systems, military weapons systems, and scientific data-gathering equipment. Realtime systems, such as those for the space flight program, met some of the most demanding requirements for concurrent processing ever devised.

In the mid-1980s all these types of applications are converging on the PC and shouldering their places among the spreadsheets and word processors. One PC now packs enough power to serve several users simultaneously in most applications. As well as having come of age as a small time-sharing engine, the PC has evolved into a serviceable hardware foundation for a large class of realtime and transaction processing systems. The IBM PC family has the processing power, memory, devices, and I/O structure that are required in the lower end of concurrent processing applications areas such as process control, robotics, transaction processing, and communications switching.

The last four years have seen the base of business software for the PC grow from a few rudimentary BASIC programs into an enormous array of sophisticated products that exploit the machine to its limits. A similar explosion is now under way in the smaller marketplace of realtime and transaction processing systems, and it is gathering momentum as more supporting software and hardware become available to product developers.

MULTITASKING BASICS

The term *operating system* has come to encompass all the systems software that stands between an applications program and the resources of its underlying machine and I/O devices. A multitasking environment need not be an operating system in this sense of the term. It can, in fact, be realized in a small set of subroutines. Strictly speaking, a software package creates a multitasking environment if it provides context switching and task scheduling.

In order to allow the construction of tasks as separate, sequential programs even though they run concurrently, a multitasking environment must

As well as having come of age as a small time-sharing engine, the PC has evolved into a serviceable hardware foundation for a large class of realtime and transaction processing systems.

provide each task with a *context*—a view of its own state (program counter, local and global storage) and the processor's state (registers, flags, etc.), which remains undisturbed while other tasks run. By switching rapidly from one context to another as it shares the processor's time among tasks, the environment creates for each task the illusion that it has a machine to itself. This illusion distinguishes multitasking from other forms of concurrent processing such as interrupt-driven applications, which process any given task based on the interrupts that are received.

Concurrent programs oblivious of each other's activities are called *asynchronous*. The ability to run concurrent,

asynchronous tasks allows a system designer to decompose a problem in which ten tasks must be done concurrently into ten simple, sequential programs instead of just one complex, state-driven program that has built-in knowledge of how to perform all ten jobs in parallel. The cost of the approach is execution overhead; the time the processor spends in context switching is time it is not spending getting the ultimate job done. Benefits of the multitasking model of concurrent processing accrue because it reduces software complexity. They are manifested in reduced design and development costs and increased system reliability.

A multitasking environment's scheduling discipline is the mechanism by which it determines when each task is allowed to run and for how long. Scheduling disciplines range from simple ones in which each task runs until it explicitly surrenders control of the processor to complex ones under which the environment chooses which task to run next using a priority system and interrupts tasks when they exceed a limit on running time or when a higher priority task is ready to run.

Outside a time-sharing setting in which many independent users compete for a single processor, a multitasking system rarely consists of tasks that are entirely asynchronous. The technique of multitasking is far more frequently applied where tasks must cooperate to share scarce resources and pass information back and forth. As a consequence, most multitasking environments, even minimal ones, provide a way for tasks to forego asynchronous operation temporarily and synchronize with each other.

Synchronization comes into play when a task needs or chooses to wait for something outside its control to happen before proceeding. For example, a task might require input from a peripheral device, a message from another task, or permission to use a system resource (perhaps a printer) that can serve only one task at a time. The environment must have some means of taking control so that it can allow other tasks to run while some wait. It must also provide the tasks with a way to signal others that an event has occurred that they might be waiting for.

All but the leanest of multitasking packages offer more than the bare essentials of context management, scheduling, and synchronization. Most provide functions addressing common higher-level needs of multitasking system architects. The need for intertask-

ing data queues, for example, is almost universal in multitasking applications, and consequently many packages include synchronized queue management facilities. Timing is another common necessity. Facilities often are provided that allow tasks to "sleep" for specified periods of time or to set watchdog timers so that they can detect device failures. Many products incorporate interrupt handling routines for frequently used devices, such as the system keyboard and serial communications ports, external terminals, and printers.

LIVING WITH DOS

The two multitasking packages examined in this article—CX/PC from INTRASoft Company and TJ/OS, a multitasking toolkit assembled by the author—fall in the category of cooperating systems, so called because they coexist with DOS. Both are subroutine packages that are linked to the user's applications program and can be called upon to establish and operate a multitasking environment atop DOS.

Because DOS itself was not built as a multitasking operating system, it lacks a property that is essential in any software serving multiple tasks: the ability to be shared. A piece of code can be shared if it can be called upon freely by asynchronously executing tasks.

One way to create code that can be shared is by making it reentrant. Programmers create reentrant code by constructing it to maintain all its local storage within a task's context (usually the processor's registers and the stack). If the placement of local storage is thus restricted, a section of code can operate correctly even when several tasks are concurrently active within it.

A weaker form of sharing can be achieved in code that is not strictly reentrant by equipping it with a mechanism that guarantees that, although many tasks may enter the code, only one at a time can proceed through its nonreentrant sections. Code constructed with such gatekeeping mechanisms is described as *serially reusable*.

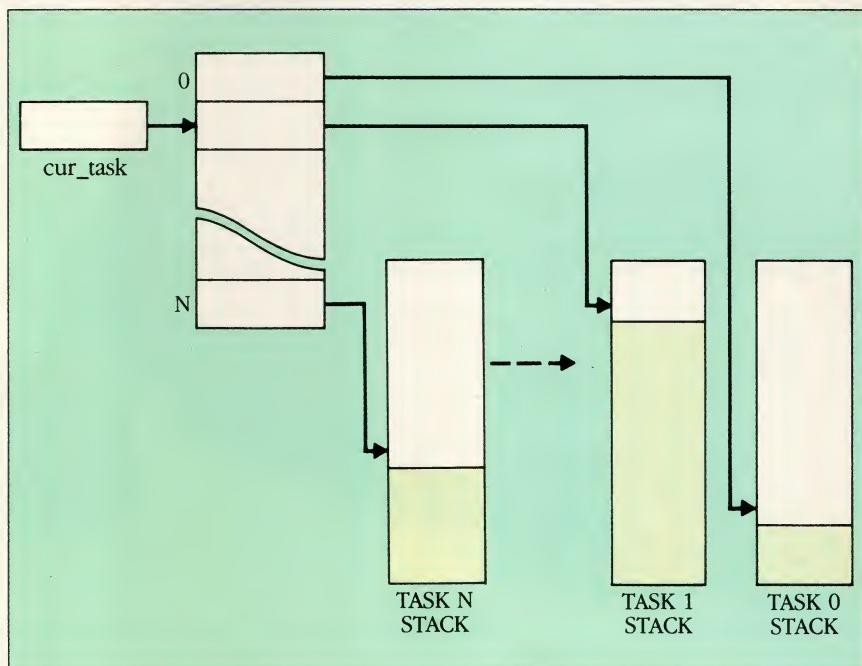
DOS is neither reentrant nor serially reusable. It operates correctly only if allowed to complete the processing of a function call and return control to the caller before undertaking the processing of another. If multiple tasks were allowed to call DOS freely, disaster would strike. Because DOS has only one set of local storage, the first time a task called DOS while its local storage held the state of a previous caller, the previous caller's state would be overwritten and lost. System failure would

TABLE 1: TJ/OS Routines

SUBROUTINE	FUNCTION
init_os() int fork(stack, stack_size) char *stack; int stack_size;	Prepares the TJ/OS environment Creates and activates a task
yield()	Allows context switching
stop()	Deactivates a task
wait (event_counter) int *event_counter;	Waits for an event
post (event_counter) int *event_counter;	Signals that an event has occurred

The six routines used by TJ/OS provide the basis for a realtime operating system. The task scheduling is nonprioritized, and each task is served on a first-come basis.

FIGURE 1: TJ/OS Environment



The data structures of TJ/OS are *task_tbl*, *cur_task*, and *actv_task*. *Cur_task* contains the index of the currently active task's entry in the task table.

occur when the first caller tried to proceed with its now-inappropriate state information. A task that had called DOS to open a disk file, for example, might erroneously return from DOS to another task's routine that had just called DOS to print a line on the printer.

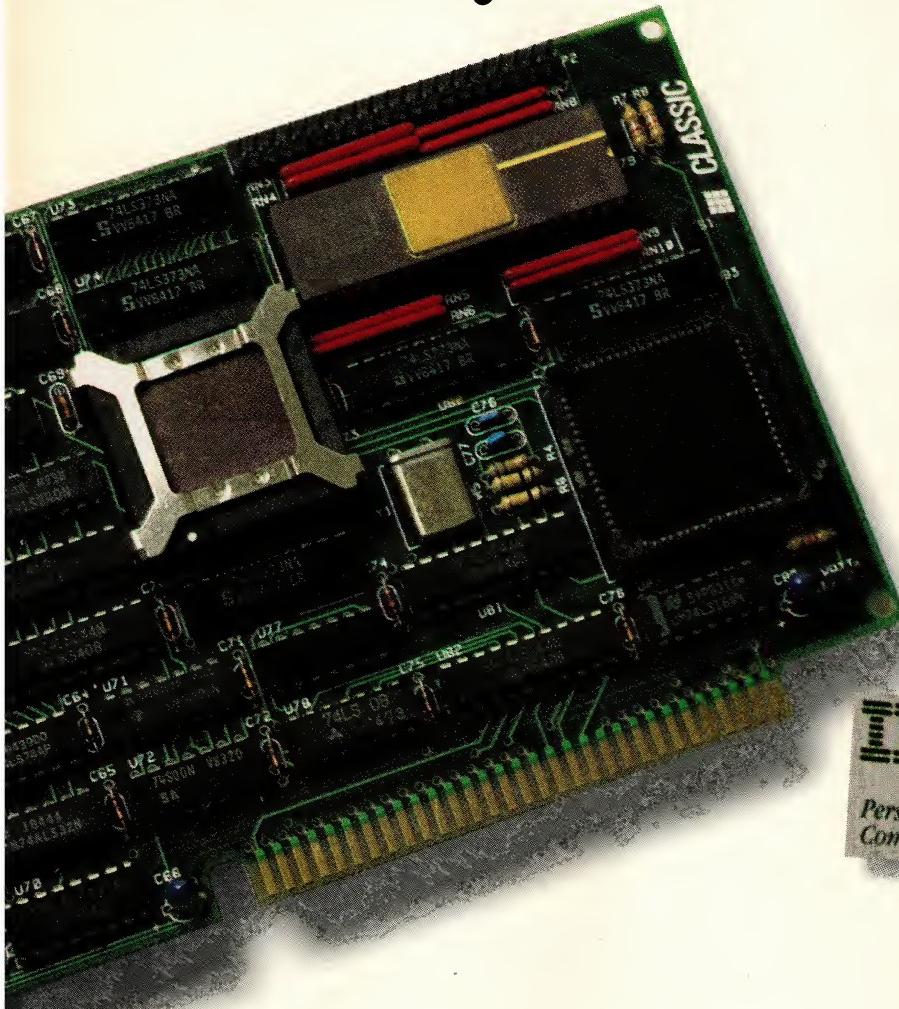
The two packages discussed below take an effective but wasteful approach to avoiding problems arising from DOS's non-reentrancy. They incorporate simplistic task scheduling disciplines that are incapable of switching task contexts while a DOS operation is in progress. Both packages can switch contexts only when explicitly called on by a running task to do so; because a task cannot call both DOS and the multitask-

ing package at the same time, a second task does not have an opportunity to enter DOS before the first has left.

Coexisting with DOS is a mixed blessing. On the positive side, the scheme is easy to implement and allows the multitasking application the use of DOS's substantial facilities, including its file system and device drivers. The price to pay for this is reduced system throughput and balky realtime response when tasks call DOS. Future articles in this series will examine cooperating systems that push DOS a little closer to its limits by permitting context switches during DOS operations.

TJ/OS (Tech Journal co-Operating System) is a multitasking toolkit assem-

How to get all the ATs you want.



A number of products promise to "make your PC perform like an AT."

Unfortunately, the resulting "AT" all too often lacks one or more important characteristics.

Like compatibility with PC and AT software. Like IBM serviceability. Like support for multitasking.

And like the ability to manage large, AT-size spreadsheets and databases.

Classic's 286 Speed Pak performs 33% faster than an AT—without damage to your PC, with no BIOS problems, and with no service problems. It's completely

hardware—and software-compatible.

And it's the only board you can upgrade to let your PC or XT perform multiple tasks simultaneously. For example, you could compile a new program, run a spreadsheet and print a large document all at once. Just add our TaskMaster multitasking software and 2.5Mb memory adapter.

- DOS 3.0 and 3.1 compatible
- 100% I/O emulation of the 8088 (no timing problems)
- 8088 native mode
- 512K or 1 Mb memory
- Can address up to 16 megabytes of memory on add-in expansion

boards ■ Optional 80287 math co-processor ■ 16-bit BIOS
■ Full 16-bit data path.

For more information about the 286 Speed Pak and the name of your nearest dealer, phone 408/434-9333. Because if you're not with Classic, you're not where it's really AT.

CLASSIC

Everything you always wanted from IBM.

CLASSIC TECHNOLOGY CORPORATION
2090 Concourse Drive, San Jose,
CA 95131 • 408 434-9333
CIRCLE NO. 106 ON READER SERVICE CARD

MULTITASKING

bled by the author to illustrate the minimum level of multitasking support. The goals in constructing TJ/OS were to provide true multitasking, to support applications written in a high-level language (Microsoft C), and to do as little programming work as possible in the process. TJ/OS consists of six C-callable subroutines, summarized in table 1 and shown in listing 1.

The Microsoft C runtime environment, like most PC language environments, maintains a single stack on which a program's local storage is allocated and in which its subroutine return addresses are stored. TJ/OS extends this environment by maintaining a stack for every active task. The structure of this environment is shown in figure 1. Its only permanent data structures are a table of active tasks (**task_tbl**), a variable (**cur_task**) that holds the index of the currently active task's entry in the task table, and a count of the number of active tasks (**actv_tasks**).

TJ/OS's scheduling discipline is egalitarian and cooperative. Tasks pass control from one to another like relay runners pass the baton. A task continues to run until it calls the scheduling and context-switching routine **yield**, which saves its context by pushing the BP (frame pointer) register onto the stack and storing the current stack pointer in the task table. The scheduler then switches to a new context by scanning the task table in round-robin order for the next active task, installing the new task's stack pointer, and executing a return instruction to transfer control to the new task. A task continues to participate in this rotation until it elects to deactivate itself by calling **stop**. (Control is returned to DOS if the only remaining active task calls **stop**.)

When saving a task's context, TJ/OS preserves only the registers BP and SP, which must be preserved across a subroutine call in the Microsoft C (small memory model) environment. TJ/OS can ignore other registers because its scheduling discipline guarantees that it will save and restore a task's context at times when compiler-generated code does not depend on the register's contents being preserved. (If an assembly language subroutine calls **yield**, it is responsible for saving and restoring any other registers it depends on maintaining across the call.)

TJ/OS, which is designed to be used with version 3.0 or later of the Microsoft C compiler, must engage in subterfuge to coax the C environment into working with more than one stack. Compiler-generated code for sub-

routines begins with a call to the routine **chkstk**, which allocates space for the routine's local storage on the stack after verifying that the stack will not overflow. Because the standard C runtime environment operates on the assumption that a program has just one stack, **chkstk**'s overflow test will not work properly in the presence of TJ/OS's stack-switching. TJ/OS ducks the problem by supplying its own version of **chkstk** that replaces the standard routine when a program is linked. TJ/OS's version forgoes the overflow test and simply adjusts the stack pointer to allocate the required space.

Under many multitasking environments, a programmer must ensure that any subroutine that can be called from more than one task (including those in the compiler's runtime library) is reentrant. Under TJ/OS, this is not a concern for the same reason that DOS's non-reentrancy is not a problem—the task scheduler is never given an oppor-

TJ/OS, which is designed to be used with version 3.0 or later of the Microsoft C compiler, must engage in subterfuge to coax the C environment into working with more than one stack.

tunity to switch contexts during the execution of routines that do not call **yield**. Only routines that call **yield** or that are used by both interrupt handlers and tasks must be reentrant.

To prepare the TJ/OS environment for use, a multitasking program calls **init_os**, which initializes the task table and sets **cur_task**, identifying the program's initial (linker/loader-established) stack as the first task's context. The multitasking environment is ready and operating with one active task at the time that control returns from **init_os** to the calling program.

Once the TJ/OS environment has been prepared, tasks can create as many other tasks as the task table will accommodate. Tasks are started in UNIX style, by calling the routine **fork**; the caller passes an array that becomes the new task's stack (stack and data segments must be identical). **Fork** creates an en-

try in the task table for the new task, sets its stack image up to cause it to appear to return from **fork**, then returns **false** to the original task. When the newly created task receives its first chance to run, it begins executing at a point in the code immediately following the **fork** call, but sees a return value of **true** from **fork** where the task that started it saw **false**. By testing their respective return values, the two tasks can branch into different execution paths.

Because **fork** slips another stack into the C runtime environment somewhat underhandedly, a newly created task must obey one unnatural rule. It must not attempt to reference the formal parameters or local variables of the procedure containing the **fork** call that created it, because these variables are defined only in the creating task's stack. For similar reasons, a subroutine in the creating task may not pass parameters to one in the created task. In light of these restrictions, TJ/OS tasks are usually spawned using a statement like:

```
if (fork(stack, stack_size)) newtask();
```

(To readers who examine the TJ/OS subroutines, some trickery is confessed in the matter of **fork** returning the value **true** to the new task. **Fork** relies on the **yield** routine to start the new task at a later time by finding its table entry, installing its context, and executing a return instruction. Because **yield** always returns **true**—its return value is ignored by tasks that call it normally—it appears to the new task that it is **fork**, not **yield**, that returns it the value.)

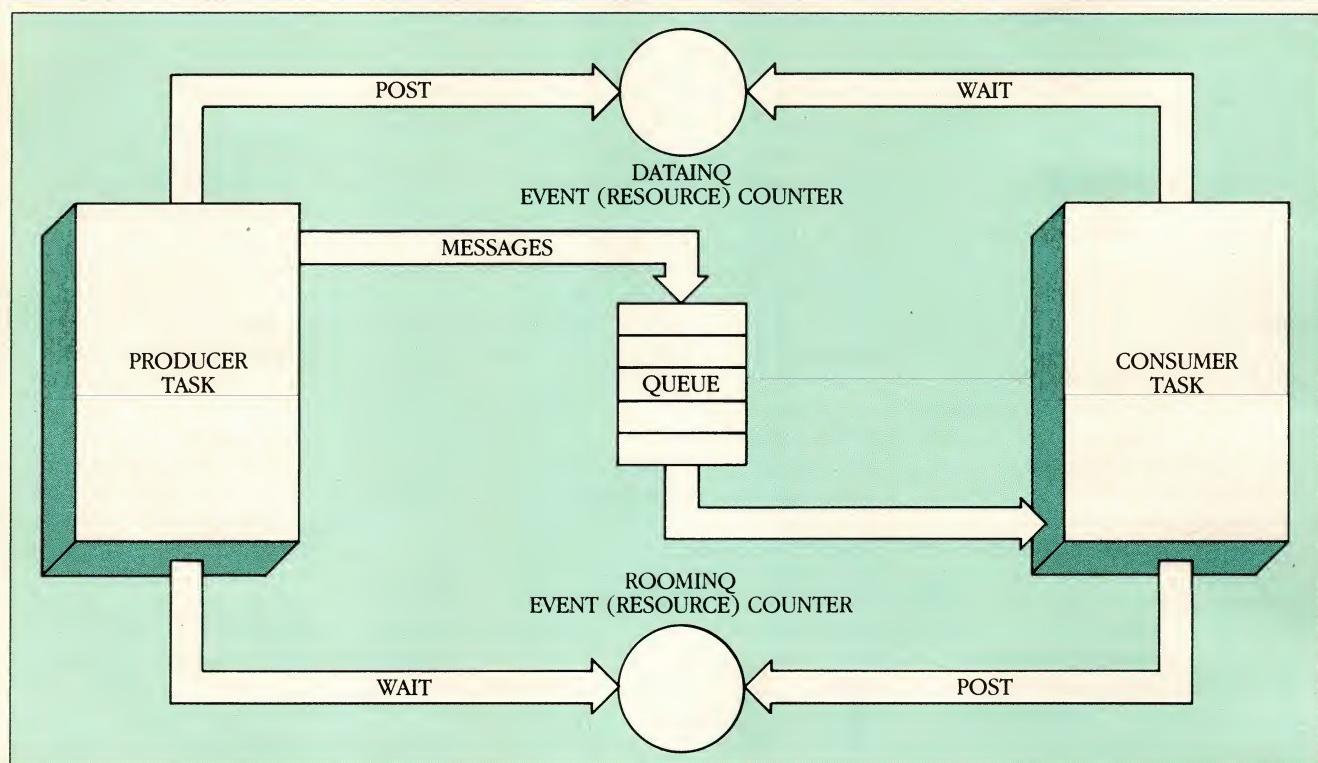
Because TJ/OS has no way of interrupting, or preempting, a running task, the environment works properly only if the tasks under its control cooperate. A task that loops in an execution path without a call to **yield** will retain control of the environment forever; its greedy behavior ends multitasking abruptly and permanently.

Tasks also must be designed to ensure that realtime response requirements are met. In a system in which one task must guarantee a response to some input event within 200 milliseconds, for example, the designer must ensure that the execution paths of all other tasks that might run between the time the event occurs and the time the limit expires consume no more than 200 milliseconds. In such cases, the price of TJ/OS's simplicity in scheduling is paid by the system designer in design and tuning headaches.

To meet realtime response requirements a designer must be satisfied that the processor is not being asked too

MULTITASKING

FIGURE 2: Producer/Consumer Relationship Diagram



In a producer/consumer relationship, each task must run only when another task has completed a particular function. Both tasks can have the same priority, but each will run only when the relevant event counter has a value greater than zero.

much; multitasking does not magically extend a computer's processing power. The designer also must observe a rule that is easy to state but almost impossible to follow strictly: if a task must respond to an external event within a fixed amount of time, then all the system's other tasks must be constructed so that the combined execution times of their longest stretches of instructions between *yield* calls is less than the fixed time limit. The rule embodies the worst-case assumption that, when the external event occurs, the task that is responsible for responding has just given up its turn at the processor and, furthermore, that all the other tasks lie in a state requiring that they traverse their most time-consuming execution paths before calling *yield*.

Short of counting instructions and adding up microseconds, designers can do very little to be absolutely certain that a system will comply with this rule the first time it is turned on. In practice, designers typically rely on intuition and follow some general guidelines in building a system, then run it under stressful realtime conditions so that they can observe its response characteristics and tune it up where it falls short.

The single most important guideline is that no task should execute too

long between calls to *yield*; *too long* is an application-dependent length of time. In many cases a natural point exists at which tasks should yield control. In a task consisting of a simple endless loop, a single call to *yield* usually can be coded on a path that is executed each trip through the loop. Tasks that perform bigger, meatier computations such as floating-point data reductions may require that *yield* calls be placed here and there amidst the computations so that the task does not tie up the processor for too long at one time. In the presence of processor-intensive requirements such as these, system tuning becomes a cut-and-try activity. The designer makes trial runs of the system and, based on observations of its behavior, breaks up lengthy computations until the desired responsiveness is achieved for all system inputs.

If an experimental approach to tuning does not work, the developer can resort to more analytical methods. The *yield* routine, for example, can be made to capture in unused memory a history of recent context switches, timestamping each entry with a copy of the system's realtime clock value. Careful analysis of the resulting voluminous raw data points to tasks that are taking processor time in excessive gulps if the sys-

tem's clock resolution is sufficiently fine. A designer who must work this hard to tune a system is probably asking too much from a nonpreemptive scheduling discipline and should consider switching to a priority-based scheduler that provides a simple, direct way to ensure that the time-critical tasks render timely responses.

Like its scheduling discipline, TJ/OS's *wait* and *post* synchronization primitives offer simplicity at the expense of some power and generality. *Wait* and *post* operate on 16-bit quantities called *event counters*. Applications systems associate event counters with anything a task might have to wait for: the occurrence of an interrupt, for example, the presence of a message in a data queue, or the use of a non-reentrant subroutine.

An event counter value of 0 indicates that the counter's associated event has not yet occurred or that no units of its associated resource are currently available. Tasks that execute a *wait* call on a counter with value 0 are prevented from leaving the *wait* routine until its value becomes positive. Executing a *wait* for an event whose counter value is positive results in the value of the counter being reduced by 1 and the waiting task being allowed to proceed.

FIGURE 3: Producer/Consumer Relationship

```
#define QUEUESIZE 16

static char msgqueue[QUEUESIZE]; /* inter-task */
                                /* message queue */

static int nextin, nextout;

static int roominq, datainq; /* event counters */

static char cons_stack[1024]; /* consumer task's stack */

main()
{
    /* start the TJ/OS environment */
    init_os();

    /* initialize the message queue and */
    /* its associated event counters */
    nextin = nextout = 0;
    roominq = QUEUESIZE;
    datainq = 0;

    /* start the consumer task, then */
    /* assume the role of producer task */
    if (fork(cons_stack, 1024)) cons_task();

    prod_task();
}

prod_task()
{
    char msg;

    /* repeatedly send the alphabet to the consumer task */
    for (;;) /* repeat forever */
        for (msg = 'A'; msg <= 'Z'; ++msg) {
            wait(&roominq);
            msgqueue[nextin] = msg;
            nextin = (nextin + 1) % QUEUESIZE;
            post(&datainq);
            yield();
        }
}

cons_task()
{
    char msg;

    /* dequeue messages from the producer */
    for (;;) /* repeat forever */
        wait(&datainq);
        msg = msgqueue[nextout];
        nextout = (nextout + 1) % QUEUESIZE;
        post(&roominq);
        yield();
}
```

Event counters are used with the TJ/OS subroutines to enable a task to recognize that an event has occurred. The first task posts an event count and then yields, allowing the second task to act on the information generated by the first task.

The logic of the `wait` routine (paraphrased in C) is simply

```
wait(event_counter) {
    while (*event_counter == 0) yield();
    *event_counter = *event_counter - 1;
}
```

`Wait` depends on the fact that TJ/OS's task scheduler knows no difference between active tasks that are waiting and those that are not. `Yield` gives each task a chance to run every time it goes through the task table.

`Wait`'s counterpart, `post`, is called by a task to indicate that an event counter's associated event has occurred or that a unit of its associated resource has become available. A `post` operation on an event counter is accomplished by incrementing the counter:

```
post(event_counter) {
    + +(*event_counter);
}
```

A simple example of two synchronized TJ/OS tasks in a producer/consumer relationship is in figures 2 and 3.

Interrupt handlers for a TJ/OS-based application are written the same way as interrupt handlers for DOS programs. They must save registers, process and dismiss the interrupt, restore registers, and execute an IRET instruc-

tion. Interrupt processors may communicate with tasks using `post`. They may not call `wait` or `yield`, however, because they run outside the context of any task. TJ/OS runs all tasks at equal priority and does not preempt running tasks, so the receipt and processing of interrupts has no effect on task scheduling, even when an interrupt handler posts events for which the tasks are waiting.

Because many tasks can wait for the same resource, `wait` must be an indivisible operation so that two tasks cannot erroneously consume the same event or resource by testing the value of the event counter before either decrements it to 0. `Wait`'s indivisibility with respect to other tasks is ensured in the TJ/OS environment by the absence of a call to `yield` on the execution path between the `while` statement's test of a positive event counter and the assignment statement that decrements the counter. Because task scheduling is nonpreemptive, a task that begins executing the `while` statement's test will finish executing the assignment statement and leave `wait` before any other task can execute the `while` test.

`Wait` is not indivisible with respect to interrupt handling routines, however, and it contains one critical section of code that must be protected from inter-

ruption (this protection is not shown in the foregoing C paraphrase of its logic). In its assembly language implementation, `wait` loads the contents of the event counter into a register to test its value; if the counter is positive, the register is decremented and its contents stored back into the event counter. Interrupt processing routines must be prevented from posting an event counter while `wait` is holding the counter's value in a register for inspection, so the `post` is not lost when `wait` stores the register back into the counter. `Wait` protects itself by disabling interrupts during this sequence of instructions.

TJ/OS's simple synchronizers are like a compass and straightedge in the hands of a draftsman. They can be used to construct nearly anything, but not without improvisation. Before moving from TJ/OS to packages richer in function, this article will look briefly at one example of a design predicament that requires some work above the level of TJ/OS's primitives to solve.

TJ/OS's event counters are poor relations of the more powerful semaphore synchronizers. Under semaphore-based synchronization, tasks that wait for an exhausted resource are automatically placed in a FIFO queue and, as sources become available, allowed to



Multi-User 10 Times Faster Half the Cost of LANs **ALLOY'S PC-PLUS**

Here's how to get the job done — faster and cheaper

Alloy's PC-PLUS is the perfect solution for sharing data among users. Faster, easier to install and maintain, and cheaper than LANs. Begin with a PC-SLAVE/16 expansion card containing an 8 MHz microprocessor which operates at over two times the speed of an IBM® PC's processor. PC-SLAVE/16 lets you read or write hard disk data up to 10 times faster than most LANs at half the cost of LANs!

How PC-PLUS expands your PC's capabilities

Add a PC-SLAVE/16 into your Add a terminal and Alloy's Work Executive software. You

have the power of **TWO PCs!** Sharing data, peripherals and printers. Add more PC-SLAVE/16 cards and terminals as you need to grow. And by adding Alloy's PC-XBUS and PC-QICSTOR, up to 31 users can communicate with the PC host and with each other. That's total utilization of your PC's capabilities and your investment in software, hardware and valuable time and data.

Speaking of investments

Because the workstations you add are inexpensive terminals, the cost of increasing your computing capability is much less with PC-PLUS than with the next best thing. When you consider how much more productive your office would be if you added another PC, choose PC-PLUS instead.

Alloy — your PC Productivity Company

Alloy brings you more than networking. It brings you a complete family of personal computer expansion products — from software to hard disks. All to make your PC more than a Personal Computer. With PC-PLUS, you get a Productivity Center plus all the benefits of a Personal Computer.

Call (617) 875-6100 today — for more information — or to see PC-PLUS in action.

ALLOY
Computer Products, Inc.

100 Pennsylvania Avenue, Framingham, Massachusetts 01701. (617) 875-6100, TWX: 710-346-0394
Alloy Computer Products (Europe) Ltd., Cirencester, Gloucestershire, England. Tel: 0285-69571, Tlx: 43340

IBM is a registered trademark of International Business Machines

CIRCLE NO. 234 ON READER SERVICE CARD FOR MORE INFORMATION

CIRCLE NO. 234 ON READER SERVICE CARD FOR SALESPERSON OR DEMONSTRATION

MULTITASKING

proceed. TJ/OS tasks are not as well-behaved. Instead of lining up in a queue, they form a disorderly mob. When the resource becomes available, whichever waiting task runs first consumes the resource and proceeds. As discussed earlier, the tasks are selected in round-robin order. Each time a task yields, the next task in order is taken. If this requires the available resource, it will take it regardless of whether other tasks have been waiting longer.

Mobbing can be undesirable when a resource must be shared fairly among competing tasks. Using event counters, two tasks can be made to consume a stream of events in strict alternation by introducing a *permission to wait* event counter for each task and coding each task to wait first for its own permission counter, then for the event's counter, and then to post the other task's permission counter (figure 4). Two tasks that consume a stream of events in an equally fair but slightly more relaxed sequence are shown on the right in figure 4. Each task has an associated event counter (*count_1* and *count_2*, respectively) that is initially set to zero. The first task is allowed to run because *count_1* is not greater than *count_2*. The task runs, then it increments the event counter by one before yielding. The second task is allowed to run because *count_2* is now not greater than *count_1*. It in turn increments its event counter, *count_2*, before yielding, which allows task one to run again.

TJ/OS is a simple, priority-less, nonpreemptive multitasking package. It provides for the dynamic creation and destruction of tasks and supports a simple but well-structured form of inter-tasking synchronization. In the hands of a programmer experienced in concurrent processing and willing to undertake applications-level solutions to timing and synchronization problems, TJ/OS can serve as a base for small, useful multitasking systems.

THE C REALTIME EXECUTIVE

CX/PC from the INTR-Soft Company was created by Walter S. Heath, who set out to build a small realtime executive package for the Z80 processor; he published an article ("A System Executive for Real-Time Microcomputer Programs," *IEEE Micro*, June 1984) describing the difficulty he experienced in gathering design information. This led to his packaging the Z80 executive as a product, CX/80, and later to the creation of CX/PC.

The CX/PC package consists of an executive module, a set of reentrant

FIGURE 4: Queuing vs. Mobbing, Two Versions

```
(initialization)
    .
    .
    permit_1 = 1;
    permit_2 = 0;
    .

task_1()
{
    for (;;) {
        wait(&permit_1);
        wait(&event);

        /* process event */

        post(&permit_2);
        yield();
    }
}

task_2()
{
    for (;;) {
        wait(&permit_2);
        wait(&event);

        /* process event */

        post(&permit_1);
        yield();
    }
}

(initialization)
    .
    .
    count_1 = 0;
    count_2 = 0;
    .

task_1()
{
    for (;;) {
        while (count_1 > count_2) yield();
        wait(&event);
        ++count_1;

        /* process event */

        yield();
    }
}

task_2()
{
    for (;;) {
        while (count_2 > count_1) yield();
        wait(&event);
        ++count_2;

        /* process event */

        yield();
    }
}
```

The problem with the lack of prioritizing tasks with TJ/OS can be improved by using two event counters within a task as shown at left. Two tasks can then be made to consume a stream of events in strict alternation. Another approach to the mobbing problem is shown on the right. The stream of events is used in an equally fair but slightly more relaxed sequence.

data queuing routines, and example applications that exercise its multitasking and queuing facilities (table 2). It includes interrupt handling routines for serial and parallel ports and a simple timing mechanism. All modules are written using the DeSmet C compiler (some contain embedded assembly language code as well as C source).

As under TJ/OS, each CX/PC task runs with its own stack. In addition to its stack, a task's context includes a task control block (TCB) in which the task scheduler records status information that is used in scheduling and synchronization (see figure 5).

The CX/PC user cannot dynamically create or destroy tasks. The number of tasks in an application must be fixed at system generation time, and the storage space for each task's stack area and TCB must be allocated before or during system-wide initialization.

CX/PC's priority scheme is straightforward. As part of system initialization, all TCBs are chained together in a

linked list, in an order determined by the system designer. A task's number is its ordinal position in this chain; task numbers are the means by which tasks identify each other when calling for service from CX/PC. The closer a task's TCB is to the beginning of the chain, the higher its effective priority.

Whenever a task relinquishes the processor, the CX/PC scheduler regains control and scans the chain of TCBs looking for a task that is ready to run. Scanning always begins with the first task in the TCB chain, and consequently this task always gets first crack at running. The nature of the chained data structure, in fact, dictates that no two tasks can have the same priority; one must appear earlier in the chain and thus will always receive more favorable treatment from the scheduler.

CX/PC, like TJ/OS, embodies a non-preemptive task scheduling discipline. Once running, a task continues until it voluntarily calls the CX/PC subroutine *sleep*, at which time the scheduler saves

Now dBASE is bilingual.

Announcing a second language for dBASE®.

C.

Now you can add richer, faster features to the dBASE you know and love with "dBASE Tools for C™".

So you can continue to program in the dBASE programming language, and yet have state-of-the-art calc speed and unique fast-painting graphics.

Here's your tool kit:

A basic engine that links C, special C libraries, and your own C functions to dBASE applications. (It supports Lattice® C, Microsoft® C, and Manx Aztec™ C.)

Arrays management and a C library of financial, mathematical, and statistical functions come with the Programmer's Library.

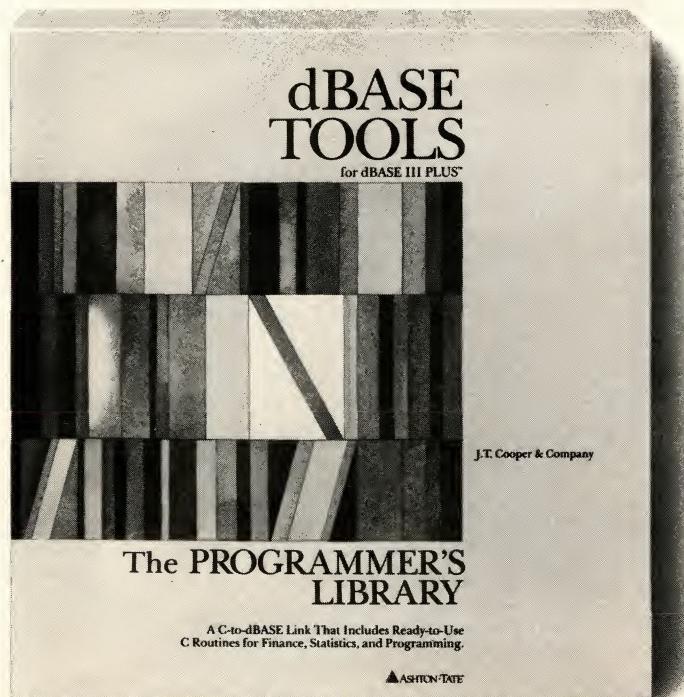
And the Graphics Library includes interactive business graphics

like bar graphs, pie charts, exploded pie charts, marked point graphs, line charts, and XY charts.

To order, for the name of your nearest dealer, or for more information, call the Ashton-Tate Publishing Group at 800-437-4329, Ext. 241.

Sure you need C to be on the leading edge.

But you don't have to give up dBASE to get it.



Trademarks/owner: Ashton-Tate, dBASE/Ashton-Tate. Microsoft/Microsoft, Inc.; Lattice/Lattice, Inc.; Aztec/Manx Software Systems Inc.
© 1986 Ashton-Tate. All rights reserved. Specifications subject to change without notice.

MULTITASKING

its context and scans the list of TCBs for another task that is ready to run.

Where TJ/OS's scheduler blindly gives every active task a turn to run whenever it comes around in the rotation of active tasks, CX/PC's scheduler is more discriminating. It maintains in each task's TCB a flag indicating whether or not the task is ready to run. If a task is not ready, the scheduler passes on to the next one. A task that calls `sleep` indicates to the scheduler that it is no longer ready to run.

`Sleep` is similar to TJ/OS's `yield` primitive; it causes its calling task to surrender control of the processor. `Sleep`'s caller, however, does not automatically get a later turn to execute as `yield`'s caller does. Unless it makes arrangements to be restarted later, a task that calls `sleep` will remain dormant until another task reawakens it.

`Sleep`'s counterpart is `wake`, which makes a task eligible to contend for processor time by marking its TCB. A task may awaken another task by calling `wake` and passing the dormant task's number. When this task is able to run, it resumes execution at a point in its code just after its last call to `sleep`.

Interrupt handling routines are permitted to `wake` tasks but are prohibited from sleeping. Because an interrupt handler can run at any time, regardless of the state of the multitasking environment, it can awaken the task that is already running. In this case, CX/PC notes in its TCB that the running task was awakened and, when the task later calls `sleep`, uses this information to override `sleep`'s normal operation by leaving the calling task marked ready to run.

The currently running task may be awakened in one other case: it may awaken itself. A task awakens itself not for immediate effect (it is already running and therefore awake), but to ensure that it will receive another chance to run after its next call to `sleep` even if no other task awakens it. The sequence of calls `wake(my_task_number)`, `sleep()` is similar in effect to a call to `yield` under TJ/OS; it relinquishes control of the processor, but with a guarantee that control will eventually return.

`Sleep` and `wake`, although they allow tasks some measure of control over each other, do not constitute a synchronization mechanism. A sleeping task is not waiting for anything in particular to happen. Similarly, a task that awakens a sleeping task has no idea of what the sleeper was waiting for.

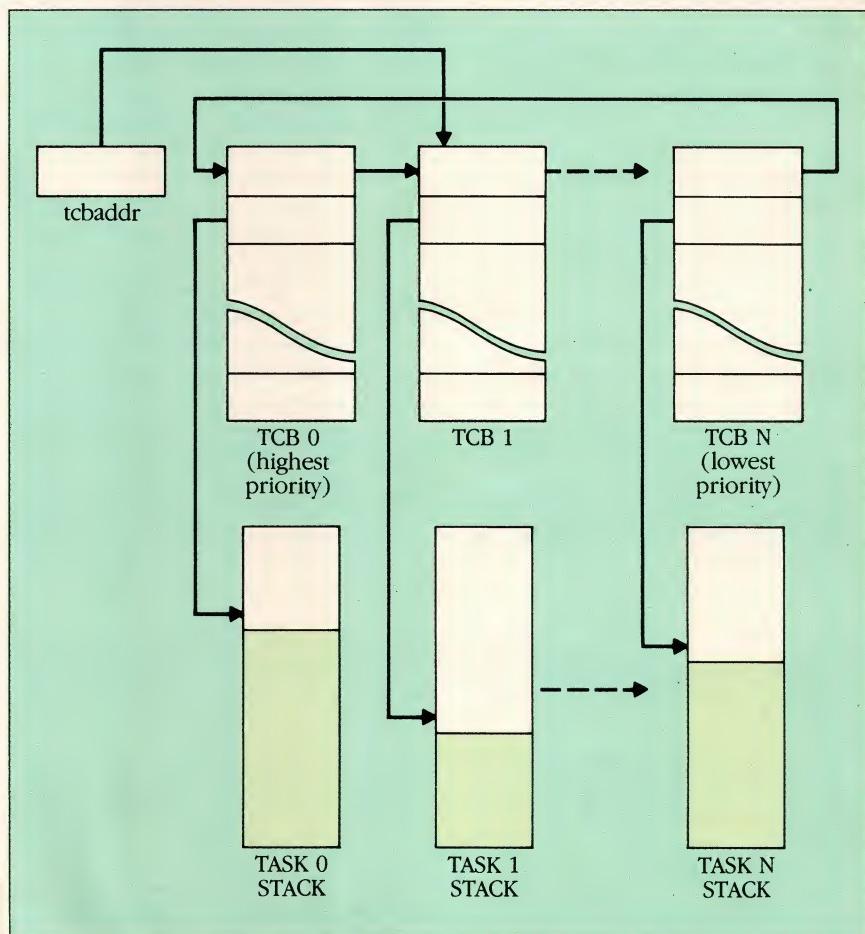
CX/PC's synchronization facilities are provided as a logical layer that sits atop the `sleep` and `wake` primitives, as

TABLE 2: CX/PC Facilities

MODULE	CONTENTS
cx1.c	Main program, system initialization, scheduler <code>sleep()</code> <code>wake()</code>
quea.c	Simple message queuing <code>putq()</code> <code>getq()</code>
quea2.c	Synchronized message queuing <code>putqwt()</code> <code>getqwt()</code>
quea3.c	"Half-synchronized" message queuing and queue utilities <code>putqwk()</code> <code>getqwk()</code> <code>getqc()</code> <code>getqd()</code>
bptr.c	Pointer-based message queuing and associated utilities <code>putbp()</code> <code>getbp()</code> <code>putbpwt()</code> <code>getbpwt()</code> <code>getbpr()</code> <code>putbpr()</code>

CX/PC can supply two different queuing technologies. Pointer-based message queuing is offered in the `bptr.c` module. Here, pointers to messages are copied instead of moving the messages themselves as in other simple queuing modules.

FIGURE 5: CX/PC Environment



The task scheduler records the information used in scheduling and synchronization in the task control block (TCB). Each task has an associated stack and TCB.

MULTITASKING

part of a data queuing apparatus. Two types of FIFO data queues are supported: one in which variable length messages are physically moved into and out of queues, and a second that manipulates pointers to messages.

The first type of queue management has as its foundation the routines **putq** and **getq**. **Putq** copies messages into a ring-structured buffer or reports failure if the buffer is full; **getq** copies messages out of a queue or reports failure if the queue is empty.

Fully synchronized queuing is provided by the functions **putqwt** (put in queue or wait if full) and **getqwt** (get from queue or wait if empty), which use **putq**, **getq**, **sleep**, and **wake**. These routines accomplish the synchronization required by two tasks in a producer/consumer relationship: **putqwt** waits for queue space if the queue is full, then puts a message in the queue and awakens the consumer task if it is waiting for a message; **getqwt** waits for a message to be deposited if the queue is empty, then removes a message and awakens the producer task if it is waiting for space in the queue.

Putqwt and **getqwt** are constrained by the nature of the queue data structure to support only single producer, single consumer task relationships. CX/PC's queue control data structure has only one slot for holding the task number of a waiting task. If the queue is full, the slot is used to hold the number of the blocked producer task; if it is empty, the slot is used to store the number of the waiting consumer.

This form of synchronized queuing nicely offsets the blind nature of the **wake** primitive. As noted before, **wake** awakens a task without regard for the reason the task went to sleep. If a producer task unconditionally awakened its consumer partner each time it depos-

ited a message in their shared queue, it would risk rousing the consumer from its sleep waiting for some *other* event to happen, causing confusion at best and system failure at worst. This problem is avoided because a producer calling **putqwt** wakes its consumer only if the consumer's task number appears in the waiting task slot of the queue control data structure. The reverse is true for consumers calling **getqwt**.

CX/PC also provides half-synchronized simple queue management. The functions **putqwk** and **getqwk** are half-synchronizers; they awaken a task that is waiting for the condition they create (queue not empty or queue not full), but they will not themselves wait (by sleeping) for a condition to arise. **Putqwk**'s asymmetric operation is especially useful in constructing interrupt handlers that must queue messages to waiting tasks. If a queue is not full, **putqwk** deposits a message and awakens the waiting task. If the queue is full, it reports failure back to the interrupt handler. Because interrupt handlers may **wake** but not **sleep**, they must use **putqwk** instead of **putqwt**. A full queue may leave the interrupt handler holding the bag with a message it cannot get rid of—this is especially a problem at higher levels of system design.

CX/PC provides an alternative queuing technology that is exactly like simple queuing in form but differs in that it copies pointers to messages from place to place instead of copying the messages themselves. This family of routines is based on the primitives **putbp** (put buffer pointer) and **getbp** instead of on **putq** and **getq**.

The bulk of CX/PC's documentation comes in the form of a reprint of Heath's original article describing his multitasking executive and simple queuing routines for the Z80. Pointer queu-

ing is documented only sketchily, but its use is illustrated clearly in the five example programs. CX/PC is delivered with complete C (and assembly) source code, so users conversant with C can resolve questions for themselves. Heath provides free technical support by telephone. CX/PC's licensing arrangement permits unlimited use and resale of the software in executable form at no additional cost, but prohibits licensees from reselling or otherwise distributing its copyrighted source code.

CX/PC furnishes priority-based, nonpreemptive multitasking and imposes minimal execution time overhead. Its synchronization facilities operate in conjunction with a variety of data queuing mechanisms. They support only single producer, single consumer task relationships, although nothing in the nature of CX/PC prevents the construction of richer, more flexible synchronizers; the **sleep** and **wake** primitives provide a simple but sound foundation.

CX/PC is suitable for small, PC-based instrumentation and control systems that can live without preemptive task scheduling. At \$75 for source and an unrestricted binary license, CX/PC is an attractive option for those seeking a model and source of multitasking experience and ideas.



CX/PC: \$75
INTR-Soft Company
P.O. Box 351
Bedford, MA 01730
617/369-0642

CIRCLE 350 ON READER SERVICE CARD

Richard M. Foard is vice president of software development for ROADNET Systems Corporation. He would like to acknowledge Bill Appelbaum of the General Instrument Corporation for his help in developing TJ/OS, which was inspired by the written contents of Bill's napkin at lunch one day.

LISTING 1: TIOS.ASM

```
; File: tjos.asm
; Auth: Richard Foard

TITLE tjos

; Routines in this module (Microsoft C subroutine linkage):
;

; init_os()
;

; Prepares TJ/OS environment for use. Upon exit, caller is running
; as first task.
;

; int fork(stack, stack_size)
;     char    *stack;
;     int      stack_size;
;
; Creates and activates a task. Returns 'false' to the calling task
; and 'true' to the newly created task.
;
; yield()
```

```
; Allows a context switch to occur.
;
; wait(event_counter)
;     int      *event_counter;
;
; Waits for an event.
;
; post(event_counter)
;     int      *event_counter;
;
; Signals that an event has occurred.
;
; stop()
;
; Deactivates and destroys the calling task.
;
_TEXT SEGMENT BYTE PUBLIC 'CODE'
_TEXT ENDS

CONST SEGMENT WORD PUBLIC 'CONST'
CONST ENDS
```

```

_BSS SEGMENT WORD PUBLIC 'BSS'
_BSS ENDS

_DATA SEGMENT WORD PUBLIC 'DATA'
_DATA ENDS

DGROUP GROUP CONST, _BSS, _DATA
ASSUME CS: _TEXT, DS: DGROUP, SS: DGROUP, ES: DGROUP

PUBLIC _init_os
PUBLIC _yield
PUBLIC _fork
PUBLIC _wait
PUBLIC _post
PUBLIC _stop
PUBLIC __chkstk

_TEXT SEGMENT
EXTRN _exit:NEAR
_TEXT ENDS

_BSS SEGMENT
max_tasks equ 8
ct_limit equ max_tasks * 2
task_tbl dw max_tasks dup (0)
cur_task dw 0
actv_tasks dw 0
_EVEN
_BSS ENDS

_TEXT SEGMENT

_init_os PROC NEAR ;init_os() {
    mov cur_task,0 ; cur_task = 0;
    mov actv_tasks,1 ; actv_tasks = 1;
    sub ax,ax ; task_tbl[0..max_tasks - 1] = 0;
    mov cx,max_tasks ;
    mov bx,offset task_tbl ;
    ini_1: ;
    mov [bx],ax ;
    add bx,2 ;
    dec cx ;
    jnz ini_1 ;
    ret ;
_init_os ENDP ;}

_yield PROC NEAR ;yield()
    push bp ; (preserve BP)
    mov bx,offset task_tbl ; task_tbl[cur_task] = SP;
    mov ax,cur_task ;
    add bx,ax ;
    mov [bx],sp ;
    yie_0: ;
    add ax,2 ; do {
    cmp ax,ct_limit ; cur_task = (cur_task + 2)
    jne yie_1 ; % ct_limit;
    sub ax,ax ;
    yie_1: ;
    mov bx,offset task_tbl ; } while (task_tbl[cur_task]==0);
    add bx,ax ;
    push ax ;
    mov ax,[bx] ;
    or ax,ax ;
    pop ax ;
    jnz yie_2 ; yie_1
    jmp yie_0 ;
    yie_2: ;
    mov bx,offset task_tbl ; SP = task_tbl[cur_task];
    mov cur_task,ax ;
    add bx,ax ;
    mov sp,[bx] ;
    pop bp ; (restore BP)
    mov ax,1 ; return(1);
    ret ;
_yield ENDP ;}

_fork PROC NEAR ;int fork(stack, stack_size) {
    mov ax,actv_tasks ;
    cmp ax,max_tasks ; if (actv_tasks == max_tasks)
    jne for_0 ; exit(1);
    mov ax,1 ;

```

```

push ax ; ;
call _exit ; ;
for_0: ;
inc ax ; actv_tasks = actv_tasks + 1;
mov actv_tasks,ax ;
pop dx ; (caller's return addr)
pop ax ; (new task stack base)
pop bx ; (new task stack size)
push bx ; (restore caller's stack)
push ax ;
push dx ;
push bp ; (preserve caller's BP)
mov bp,sp ; (and caller's SP)
add ax,bx ; (establish new task's base sp)
sub ax,4 ; (allow pop of fork's parameters)
mov sp,ax ;
push dx ; (new task return addr)
push ax ; (and bp register image)
mov bx,offset task_tbl ; (find free slot in task_tbl)
for_1: mov ax,[bx] ;
or ax,ax ;
jz for_2 ; ;
add bx,2 ;
jmp for_1 ;
for_2: mov [bx],sp ; (install new task in task_tbl)
    mov sp,bp ; (restore caller's stack)
    pop bp ; (and BP)
    sub ax,ax ; return (0);
    ret ;
_fork ENDP ;;

_wait PROC NEAR ;wait(event_counter) {
wai_0: pop cx ;
    pop bx ;
    push bx ;
    push cx ;
    cli ; (protect test-and-set)
    mov ax,[bx] ;
    or ax,ax ;
    jnz wai_1 ; while (*event_counter == 0)
    sti ;
    call _yield ; yield();
    jmp wai_0 ;
wai_1: dec ax ; --(*event_counter);
    mov [bx],ax ;
    sti ;
    ret ;
_wait ENDP ;;

_post PROC NEAR ;post(event_counter) {
    pop cx ;
    pop bx ;
    push bx ;
    inc word ptr [bx] ; ++(*event_counter);
    jmp cx ;
_post ENDP ;;

_stop PROC NEAR ;stop() {
    mov ax,actv_tasks ; if (--actv_tasks == 0) exit(0);
    dec ax ;
    jnz sto_0 ;
    sub ax,ax ;
    push ax ;
    call _exit ;
sto_0: mov actv_tasks,ax ;
    mov bx,offset task_tbl ;
    mov ax,cur_task ;
    add bx,ax ; task_tbl[cur_task] = 0;
    mov word ptr [bx],0 ; (join 'yield' to switch context)
    jmp yie_0 ;
_stop ENDP ;;

__chkstk: ;chkstk:
    pop cx ; (allocate AX bytes of stack space)
    mov bx,sp ;
    sub bx,ax ;
    mov sp,bx ;
    jmp cx ;
__chkstk ENDS ;;

_TEXT ENDS

```

Diary of an

I traded my 16K machine and all those disks for Lotus® 1-2-3 and 256K. And immediately got the urge to merge. I started by merging regional statements in Maine. But before I could get to Iowa, I ran out of gas.

At 512K, I discovered what the coordinates IV169 looked like. I was so far out there it felt like I was walking on the moon. It didn't take long to find out 512K was nothing more than a walk around the block.

640K! Loads of space until I fell in love with integrated software and was back to cutting up files again. Sure, the other functions make my worksheet more persuasive, but I'm back to slugging in and out disks. Shades of 16K.



Old war stories of how you fought your way up through the memory ranks are great to remember as long as you don't have to relive them. And you don't.

Thanks to one incredible breakthrough. Above™ Board PS.

Above Board is the memory board that drove the Lotus®/Intel/Microsoft® expanded memory specification, Infoworld's 1985 Peripheral Product of the Year.

From Intel. The company that has driven more standards than all of the other chip shops put together.

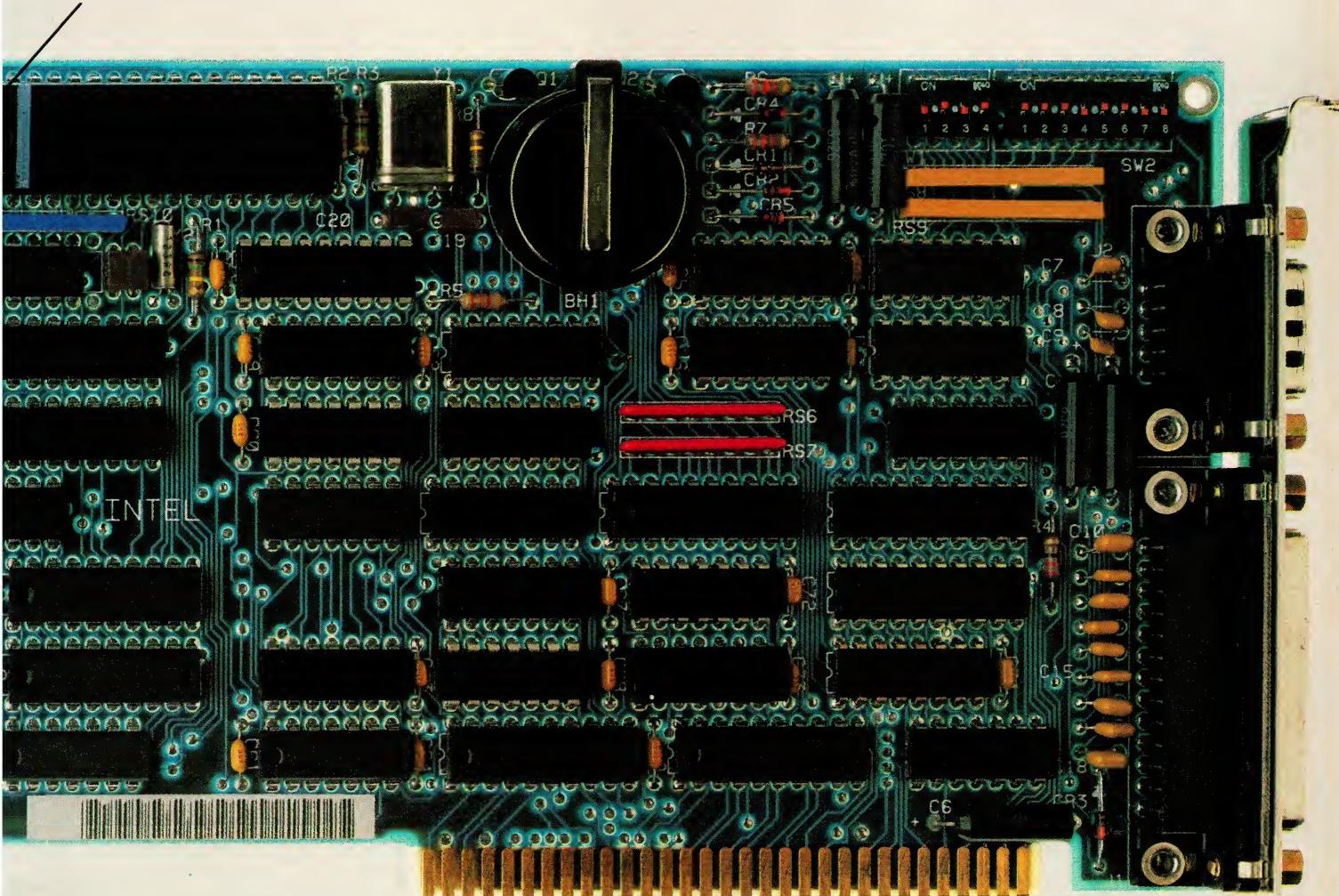
Above Board PS has the parallel and serial ports, clock, print buffer, and RAM disk you'd expect from a conventional multifunction board.

But why buy a conventional board when Above Board PS can take you from 256K all the way to 1.5 megabytes in one fell swoop, without even pausing for a breath at 640K.

So you don't need to hot-wire your way to the top anymore. With Above Board PS, the split worksheet is history. The new norm is windowing, pop-ups, and

overachiever.

I'm on my way to 1.5 MB and I'm not looking back. Monster spreadsheets, killer models, Microsoft® Windows, and all kinds of pop-up utilities so I can juggle a bunch of balls at once.



RAM speed on everything—even databasing and word processing.

The second-biggest difference between Above Board PS and conventional multifunction boards is the unconventional warranty on it. Five years instead of the usual two.

Ease of installation is nothing to sneeze at either. Its software installs with as few as three keystrokes. It even intelligently customizes your memory allocation.

Above Board PS is part of a family of products

for the IBM PC, XT, AT and compatibles.

You can buy them at your favorite computer store. Or call 800-538-3373 for the names of dealers near you.

And re-write the book on overachieving.

Help for the overachiever.

intel®

THE PC'S LIMITED AT™—\$1995. THE PC'S LIMITED TURBO PC™—\$795.



At these prices, it's no wonder
we're burning up the marketplace.

Yes, you can believe it. Since we ran our first advertisement for the PC's Limited AT™ and Turbo PC™, the calls we've received mostly start with comments like "Is this for real?" And "How can that be?" But now that our machines are in the hands of influential buyers, the questions tend to concern quantity discounts for further purchases. (Which are available.) You see, the PC's Limited machines are assembled from components bought worldwide with our strong buying power. Then they are offered directly to you—with no middleman markups. So light a match to your old budgets. With the savings we're providing, you'll have money to burn.

PC'S LIMITED AT™

- 80286-based System Unit running at 6MHz. (8MHz option included at no charge.)
- 1024K on Mother Board
- 1.2 Meg Floppy Drive
- Combined Floppy/Hard Disk Controller Card
- AT Keyboard
- 192W Power Supply
- 2 Serials and 1 Parallel Port
- Clock/Calendar with Battery Backup

Runs all Major Software written for the IBM PC™, PC XT™, and PC AT™. Unit has 8 Expansion Slots. Same Bus Configuration as IBM PC AT™. One year limited warranty.

GW Basic \$95 • DOS 3.1 \$85 • 80287 \$195

PC'S LIMITED TURBO PC™

- 16-bit 8088-2 System Unit (running at 4.77 or 6.66 MHz)
- 640K on Mother Board
- 360K Floppy Drive
- AT Keyboard
- 135W Power Supply

Runs all Major Software written for the IBM PC™ and PC XT™, 40% faster, without modifications. Unit has 8 Expansion Slots, with 7 available in above configuration. One year limited warranty.

GW Basic \$95 • IBM DOS 3.1 \$85 • 8087-2 \$149

IBM® is a registered trademark of International Business Machines Corporation.
IBM PC, PC XT, and PC AT are trademarks of International Business Machines Corporation.



PC'S LIMITED™

SALES CALLS OUTSIDE TEXAS, 1-800-426-5150

1611 Headway Circle, Building 3, Austin, Texas 78754

Sales Calls from anywhere in country, (512) 339-6962

Technical Support Calls, (512) 339-6963 Customer Service Calls, (512) 339-6964

Telex No 9103808386 PC LTD FAX (512) 339-6721

CIRCLE NO. 145 ON READER SERVICE CARD

Ad Number A03/86

Breaking out with Periscope

This symbolic debugger, with its breakout button and powerful command options, stands unrivaled for its flexibility.

WARD CHRISTENSEN

Periscope is a symbolic debugger that can be accessed from anywhere within an operating system or a specific application with one simple press of a button. It provides a superset of DEBUG's commands and is equipped with the hardware necessary to protect against the dangers of most system crashes. The convenient break-out button invokes the debugger with a nonmaskable interrupt (NMI), and an optional protected memory board shields it from applications that can wipe out memory. Periscope can accept the symbol information of some popular C, Pascal, FORTRAN, BASIC, and as-

ILLUSTRATION • ANDY LEVINE



PERISCOPE

sembly language compilers. In addition, because it relies only minimally on custom hardware, Periscope can be used on an IBM PC, PC/XT, or PC/AT, as well as many clones.

Periscope is a hardware-assisted debugger; it falls between software debuggers, such as DOS's DEBUG, and hardware-assisted debuggers that monitor the processor and bus. (See "Untangling Programs," Steven Armbrust and Ted Forgeron, April 1985, p. 81 for a review of hardware-assisted debuggers.) Periscope lacks the power of debuggers that monitor the CPU directly; it cannot, for example, trace a program running at full speed. However, it duplicates functions of hardware debuggers that cost ten times as much.

Periscope is available in two models: I and II. Both include the debugging software and a breakout button equipped with a five-foot cable. Periscope I includes a memory board with 16KB of protected memory. The software can be configured to reside entirely on this board, thus taking up none of the PC's 640KB of contiguous memory. This configuration protects against runaway programs (because only the NMI vector is exposed) and allows for non-DOS debugging. A user working in another operating system need only point the NMI vector (INT 2) to Periscope to access the debugger.

Users who have no need of the added features of Periscope I should opt for Periscope II, which does not include the protected memory board. It is memory resident and costs about half as much as Periscope I.

THE BREAKOUT BUTTON

Periscope's breakout button allows the user to take control of the debugger under any circumstances. With this unique feature, the user can, for example, interrupt a program caught in an infinite loop. Spontaneous use of the button can reveal where a slow-running program spends its time.

The breakout button can come in handy in other situations, also. For example, Periscope was used on a disk formatting program that had the annoying habit of spinning the disks with the head engaged until it received the go-ahead character and started formatting. When it finished formatting one disk, it looped back to its prompt and spun the heads again. By hitting the breakout switch at that point and examining the program flow, an appropriate patch could be fashioned.

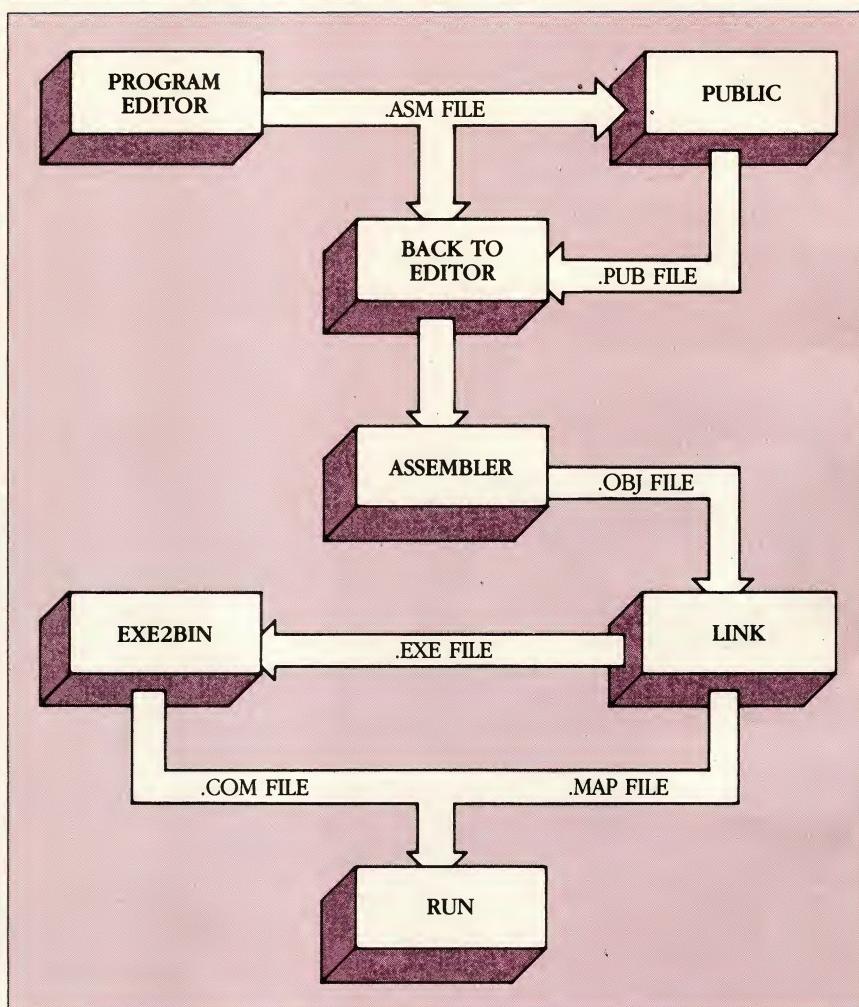
Another case of unplanned debugging involved reverse video on a color

FIGURE 1: Interleaved Source

```
>us .a36                                <- Unassemble source line 36
Source file for module A ? ascii.c    <- Periscope asks for filename
A36:      if(argc<2)           <- interleaved source code
1AC6:0249 837E0A02    CMP    WORD PTR [BP+0A],+02
1AC6:0260 7D2C    JGE    A43
A37:      { puts("Syntax:");
1AC6:024F B8DE08    MOV    AX,080E
1AC6:0252 50    PUSH   AX
1AC6:0253 E82613    CALL   PUTS
1AC6:0256 88E5    MOV    SP,BP
A38:      puts("\tascii filename");
>
```

A symbolic debugger is able to interleave source code with the machine instructions that a compiler produces from that source code. The compiler must supply the symbol and line number information required by the debugger.

FIGURE 2: Assembly Language Symbols



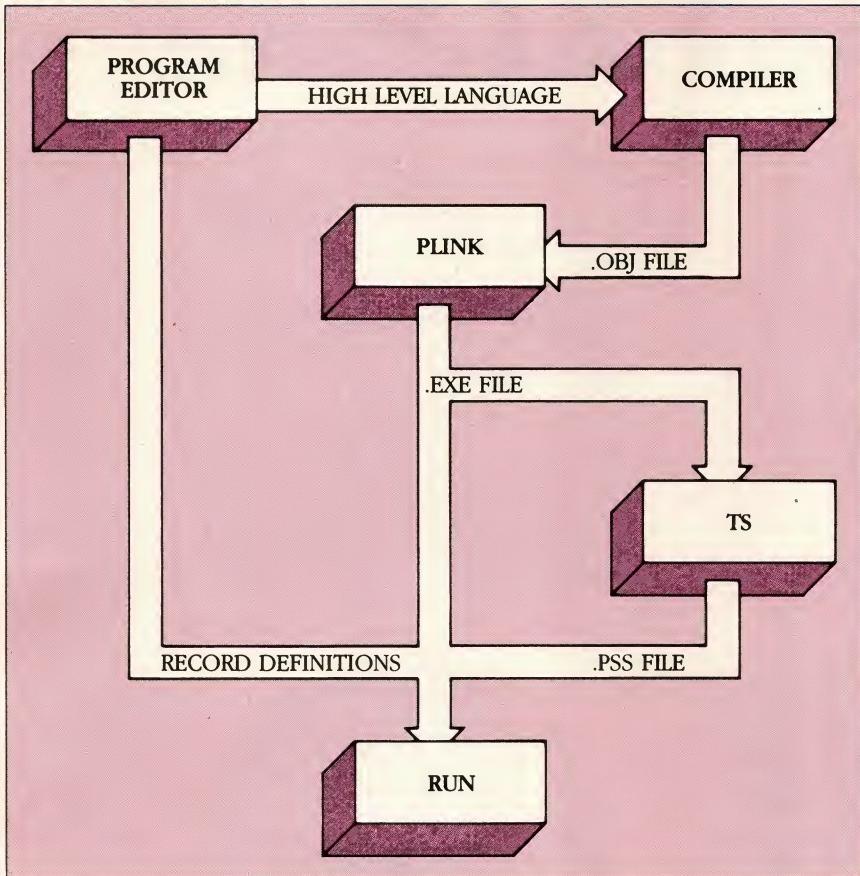
Symbol information is transferred from a programming set-up to Periscope's RUN.COM debugger, and assembly language source is compiled to a .COM file. Periscope's PUBLIC.COM ensures that all source code symbols are declared public.

screen. The screen was blanking (to black) whenever scrolling occurred. By putting Periscope into trace mode it was able to look for the code that blanks the screen. Periscope found the code residing in ANSI.SYS. It then

erased the blanking and the wait-for-retrace code, which resulted in a much more pleasant display.

Periscope again saved the day when the message buffer of a communications program was accidentally

FIGURE 3: High-level Language Symbols



A different choice of language and linker necessitates a different path for symbol information. Above, a high-level language is compiled to an .EXE file. Variables are declared public, and the optional record definitions are placed in a regular text file. Note that Periscope works with Phoenix's Plink as easily as with DOS's LINK.

deleted. I hit the breakout switch, found the data, moved them up high in memory, and returned to the communications program. I later moved the data down and wrote them to a file.

Using Periscope to trace the INT 16 keyboard interrupt revealed that the Seaware Extended Batch Language (BAT) did not simply place characters in the DOS keyboard buffer, thus limiting the number of characters that could be stacked and possibly causing problems when the user tried to run another program. Instead, it was taking control of the system to check the queue for entries. Only then did it pass control on to the BIOS. DOS's DEBUG would have been inadequate in this situation; it has trouble tracing programs that are not loaded by DEBUG.

Periscope is a real help in debugging C programs because line numbers and symbols are available. The user can learn much about a compiler by interleaving lines of C source code with the assembly language code that those source lines generate. The assembly

language code generated by Lattice C is shown in figure 1.

Using Periscope to perform traces in DOS also can be instructive, but the user should be aware that an NMI can scramble the stack registers in older copies of DOS 2.x (see "Patching a Bug in DOS 2.1," Tech Notebook 27, Don Awalt, November 1984, p. 71). The errors, which also affect single-stepping through DOS, are caused by the order in which SS and SP are loaded.

Periscope's design allows debugging of non-DOS operating systems and device drivers (which load before the user gets a DOS prompt). To use the debugger in systems other than DOS, the user must load DOS and install Periscope as usual, then select Periscope's short boot option to jump into the non-DOS system. Periscope will continue to function because it uses DOS calls only to read and write disks. Periscope's memory is protected; thus, no other system can modify it. If the system overlays the NMI interrupt vector pointing to Periscope, the user can

write a program under a second operating system that will point the NMI back to Periscope. Periscope II also can be used to debug non-DOS systems if it is successfully hidden from the new operating system. Neither version of Periscope works with 80286 operating systems that switch to protected mode.

Periscope is hardware protected; however, it cannot survive all system crashes. Two particular points of vulnerability exist. First, as mentioned above, a program can overwrite the NMI vector. In addition, a program could mask the ports through which NMI travels.

PERISCOPE SOFTWARE

Periscope commands are processed by the memory-resident program PS.COM. Periscope I loads PS.COM into the protected memory board (called Submarine); Periscope II loads it into DOS memory. When invoked (usually from AUTOEXEC.BAT), the PS command allows the user to customize the debugger. The user chooses the memory and port addresses of the Submarine board; the size of the windows for dump, register, stack, and disassembly; the color to be used in debugging displays; whether to use a second monitor for debugging; whether to install help text; and how much memory to reserve for screen save, record definitions, and the symbol table. Additional options allow the user to define which BIOS interrupt vectors are to be left alone.

To be truly useful, Periscope must be able to accommodate a large number of compilers and linkers, a requirement it fills admirably (see figures 2 and 3). The user can access public variables from Lattice, Microsoft, IBM, and Computer Innovations C, as well as from Microsoft and IBM Pascal. Any assembler that allows public symbols (in other words, almost any assembler) can pass symbols to Periscope. Some symbol information is available from Microsoft and IBM BASIC. Periscope accepts MAP files directly from DOS's LINK, and special utility programs allow Periscope to use symbol information from Phoenix and DRI linkers.

Several ancillary .COM files implement symbol support and record definitions. The user must provide these Periscope programs with the appropriate symbol and line number information (see figures 2 and 3). This involves declaring variables public and specifying a compiler option as well as the necessary linker options. In Lattice C, for example, the user invokes the -d compiler option to include line numbers in the .OBJ file. The /L and /M options of

Only the Hayes® Transet 1000® can get you out of this one.

DESPERATELY
NEED MARKETING
PLAN 10AM!

Jerry.

New York
Transmitting Sales
figures before
10 A.M.
Jane

Please print
out specs for
10am meeting.
— Frank.



© 1986 Hayes Microcomputer Products, Inc.

Now your PC can do three things at once instead of making you wait while it does one thing at once.

We call it triple tasking.[®]

It means you can work with your PC while the Transet 1000 receives your electronic mail and runs your printer for you simultaneously.

Three jobs at once. No waiting.

When you're away from your desk, or at night while your PC is turned off, Transet 1000 serves as an electronic mailbox.

Because it has its own independent 128K or 512K memory.

To get the messages that come in through the night, you can call them up on your PC. Access them through a remote modem if you're away from the office.

Or even have them waiting for you in hard copy.

By now it's dawning on you

that Transet 1000 can make your PC about three times as productive as it is now. Which is no small statement.

You've also figured out it's more than just a print buffer. More than just a communications buffer. And probably costs a lot. Right?

Wrong!

It costs only \$399* for the 128K model which stores up to 90 pages. And only \$549* for the 512K version with up to 360 pages of storage.

For more information and specifications, contact your authorized Hayes dealer. Or Hayes directly at (404) 441-1617.

Hayes Microcomputer Products, Inc., P.O. Box 105203, Atlanta, Georgia 30348.



Hayes®

Say yes to the future with Hayes.

*Manufacturer's estimated retail price.

CIRCLE NO. 155 ON READER SERVICE CARD

PERISCOPE

DOS's LINK will pass this information along to the .MAP file.

Periscope's utilities aid in this process. The PUBLIC.COM utility in figure 2 reads .ASM files and produces lines of assembly language that declare all symbols public. The lines are merged back into the .ASM file with a text editor. The TS.COM utility shown in figure 3 accesses symbol and line number data from Phoenix and DRI linkers.

The capability to perform record definition is another advantage of Periscope (see figure 4); the user defines records with an ASCII editor. Definitions for the file control block, the program segment prefix, the .EXE file header, and the Periscope data header are included on the distribution disk.

The Periscope program RUN.COM loads a file along with its symbols and record definitions; it is analogous to DEBUG. Because all Periscope commands are available through the resident PS.COM program, RUN.COM is needed only for symbol and record support or for traces that must be started before a program is executed.

RUN is better suited than DEBUG for work on programs with bugs related to memory position. DEBUG loads programs higher in memory than they normally would run; DEBUG's code is resident below the running program. RUN passes control to the resident PS debugger, and the program is loaded where it normally would be loaded.

BETTER THAN DEBUG

Periscope's commands are more powerful than those of DEBUG (table 1 shows a selection of these commands). Many single-letter functions, such as D (dump), can take an optional sub-operand: DB dumps in byte format (this is the only format DEBUG supports); DW dumps words; and DD dumps double words. The DR command dumps an area of storage based upon the appropriate record definition. For example, DD 0:0 gives an interrupt vector dump that groups segment and offset together. The resulting entries look like F000:FEA5..., which is a very readable format. A record definition can be created to lay out the common interrupt vectors. Thus, typing DR 0:0.INT with each interrupt vector named produces a nicely formatted dump.

Because of Periscope's many options, the user must specify a suboption or enter a space following the primary option. Typing D100 (as required with DEBUG) produces an error. Instead, the command must be typed with a space following the D or as DB100. If no sub-

FIGURE 4: Record Definitions

```

>v fcb.def <- view definition text

|FCB| ; File Control Block
Drive,b,1 ; Drive 0=default, 1=A, 2=B, etc.
File,b,8 ; File name
Extension,b,3 ; File extension
Block No,w,2 ; Current block number
Rec Size,w,2 ; Logical record size
File Size,d,4 ; File size
Date,w,2 ; Date of last update
Res.,b,10 ; Reserved for DOS
Rec No,b,1 ; Current relative record number
Rel Rec No,d,4 ; Relative record number from beginning of file
>
>dr ds:5c .fcb <- dump FCB with definition
Drive 03
File 44 55 4D 50 20 20 20 20 DUMP
Extension 43 4F 4D COM
Block No 0000
Rec Size 0080
File Size 0000:0600
Date 0751
Res. 84 51 42 8E 00 00 00-8E 00 00 00 00 00 00 00 00 .08.....
Rec No 00
Rel Rec No 6854:2000

```

Record definitions are an ingenious new feature of Periscope. Here, a file control block (FCB) template makes sense of a memory dump. The FCB shown has been opened, and one record has been read.

option is specified, the dump format remains as it had been specified previously. For example, DD 0:0 dumps from 0:0 in double word format, and any subsequent D commands continue to dump in that same format.

Periscope is a symbolic debugger, which means that any time a numeric operand is allowed in a command, a symbol (preceded by an at sign or a period) may be used. Thus, when 1B7C equals buffer, the location can be dumped with DB1B7C, DB@buffer, or DB.buffer. The MAP file has symbol entries for PUBLIC labels only. As a result, the user may want to make many of the labels in a program PUBLIC so they can be referred to during debugging. Periscope supplies a program called PUBLIC.COM that makes all labels in the ASM program public.

The A command assembles input into memory. It allows symbols to be referenced. An AU command unassembles each line as it is assembled to ensure that Periscope assembled the lines as the user expected. For example, if the user types in the line

MOV AL,[BX]+2

Periscope immediately returns

8A4702 MOV AL, [BX + 02]

Periscope's response implies that it prefers the offset from base to be included within the brackets.

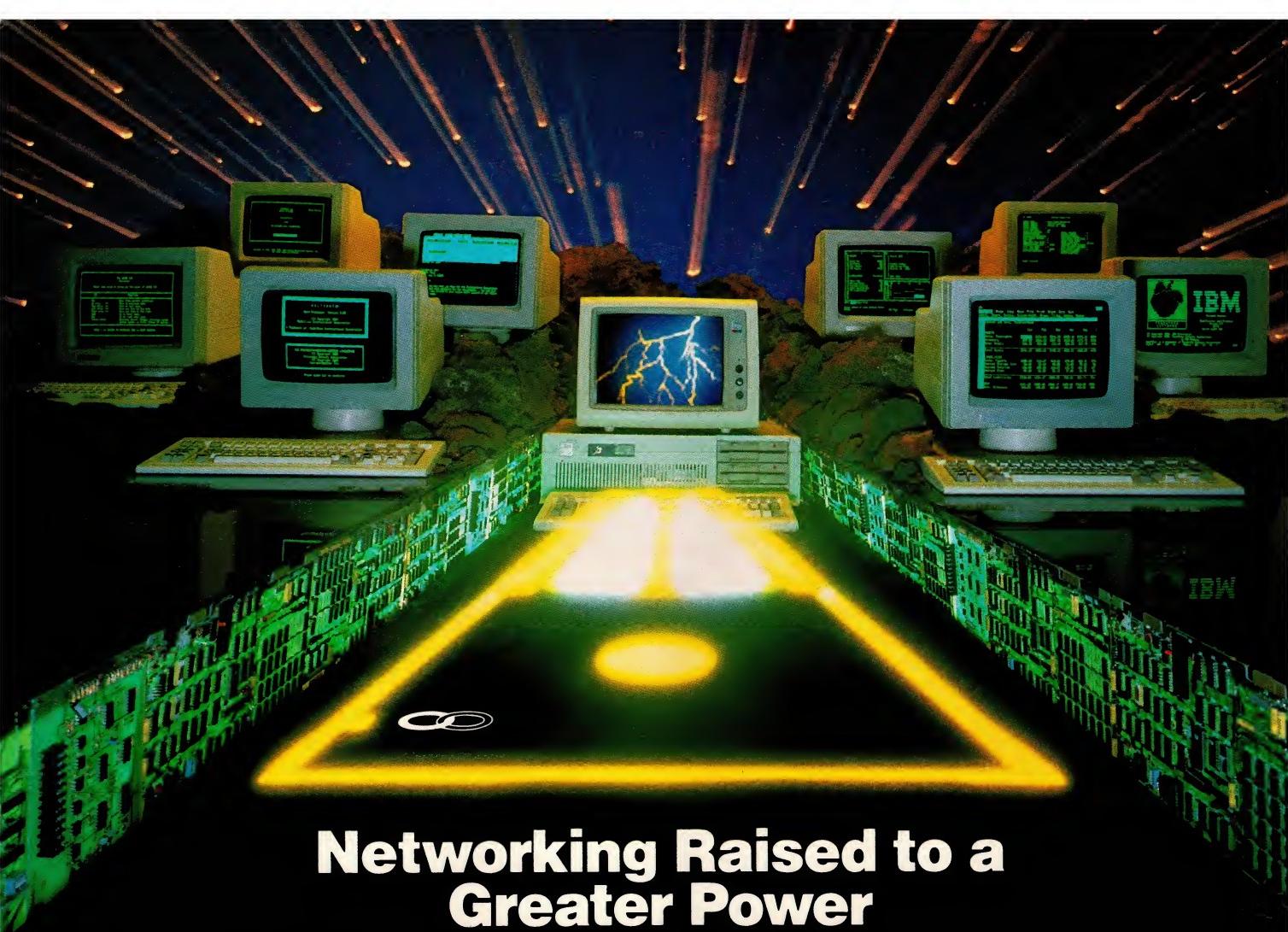
The G command (go) is similar to that command in DEBUG—it begins

full-speed execution. One or more temporary breakpoint addresses may be specified. Execution returns to Periscope when any of the temporary breakpoints are executed or when the breakout switch is pressed.

The BC command (breakpoint code) is used for more sticky breakpoints than the temporary ones that are specified with the G command. The command BC<address> sets a code breakpoint that remains in effect until cleared with BC* or disabled with BC-.

Other variations on the breakpoint command are possible; all require execution in single step mode, which is invoked with the GT command (go in trace mode) and which uses the 8088 single step hardware interrupt. Periscope single steps from several hundred instructions per second (with some tests enabled) to more than 1,000 instructions per second (when GT is executed with no tests enabled). This rate allows the user to monitor the screen and press the breakout switch immediately following any particular condition.

The commands and conditions that can be tested while running under GT are: BB to breakpoint on a byte of memory meeting some condition (less than, greater than, equal to, or not equal to some value); BI to break when the next software interrupt is executed; BL to break when the next source line (of a high-level language) is executed, which allows the user to single step lines of a high-level program; BM to



Networking Raised to a Greater Power

Advanced Technology. With it, IBM tripled the speed of the PC and increased its memory capacity five-fold. Nowhere is this increase in computing power more important than in networking situations. If the AT's technological advances have prompted you to look into a multi-user network, you owe it to yourself to take a closer look at MultiLink Advanced™ . . . a unique multi-tasking, multi-user networking system that runs programs under PC-DOS 3.0.

Eight Workstations for the Price of an AT. MultiLink Advanced™ represents the next generation in networking systems for IBM microcomputers. The system enables terminals, connected to a single AT, to emulate IBM-PC's having up to 448K of RAM (The PC-Shadow™ terminal, shown above, even has a PC look-alike, as well as work-alike keyboard and display).

This means that instead of spending \$3,000 per workstation for a PC with a Kilobuck "Network Interface Board," you can use inexpensive terminals . . . eight of which cost less than an IBM AT. Even if you need only one workstation connected to your AT, you'll realize significant savings.

MultiLink Advanced™ . . . Instant Access to All of Your Resources. Central to most multi-user situations is the need to coordinate a variety of printers. With what's been described by *PC-Tech Journal* as ". . . by far, the best print spooler for the IBM PC," MultiLink Advanced™ gives users the option to print either at their workstations, or at a central location. In addition, programs and files can be shared by multiple users locally or through use of a modem. Just think of it . . . having remote access to an AT with a lightweight terminal/modem.

Although designed to take advantage of the AT, MultiLink Advanced™ runs on all versions of PC-DOS, except 1.0, and certain implementations of MS-DOS. A wide range of leading programs are supported which include WordStar, dBASE III, Multimate, and Lotus 1-2-3.

Get the Advanced Story Today. Call The Software Link Today for complete details and the dealer nearest you. MultiLink Advanced™ is immediately available at the suggested retail price of \$495 and comes with a money-back guarantee. VISA, MC, AMEX accepted.

Multilink™ ADVANCED

THE SOFTWARE LINK, INC.



IBM PC, AT, & PC-DOS are trademarks of IBM Corp. MS-DOS, WordStar, dBASE III, Lotus 1-2-3, and Multimate are trademarks of Microsoft Corp., MicroPro, Ashton-Tate, Lotus Development Corp., & Multimate International, respectively.

8601 Dunwoody Place, Suite 632, Atlanta, GA 30338 Telex 4996147 SWLINK

CALL: 404 998-0700

Dealer Inquiries Invited

THE SOFTWARE LINK, INC./CANADA
400 Esna Park Drive, Suite 18
Toronto (Markham), Ont. L3R 3K2
CALL: 416/477-5480

MultiLink Advanced™ & PC-Shadow™
are trademarks of The Software Link, Inc.

TABLE 1: Selected Commands

DUMP MEMORY	
DB	Dump in byte format
DW	Dump in word format
DD	Dump in double word format
DI	Dump in unsigned integer format
DR	Dump into user-defined record template
TRACE EXECUTION	
G	Start execution at full speed
GT	Execute at reduced speed, monitoring all breakpoints
BREAKPOINT OPTIONS	
BB	Set breakpoint on byte =, <,>,<> specified value
BW	Same as BB but compares words instead of bytes
BR	Break on register =,<,>,<> value
BI	Break on next interrupt call
BL	Break on next source code line
BM	Break when range of memory referenced
BP	Break when particular port referenced
BU	Break on a user-specified condition
BA	Display, enable, disable or clear all above breakpoints
BC	Set a permanent breakpoint (trace mode not required)
MISCELLANEOUS	
SU	Search memory for assembly language operand
ES	Define a new symbol and add it to table
DE	Display effective address of current instruction
US	Interleave lines of source with assembly language

Part of Periscope's versatile command set is listed above. Each command has further suboptions; those with numeric arguments accept symbols. If "BUFFER" is at 1B7CH, then DB.BUFFER is equivalent to DB 1B7C.

breakpoint on some memory range being read and/or written; BP to break when a particular port is read or written; BR to breakpoint on a register meeting some arithmetic condition; and BW to breakpoint on a memory word meeting some condition. A user-specifiable breakpoint, BU, allows the user to write an assembly language program to test for "anything he wants." It is called by Periscope and returns a flag that indicates whether or not a breakpoint should be taken. This could be used, for example, to instruct that a break be taken only when an INT 17 is executed with a 1BH (escape) in AL.

The final breakpoint commands enable, disable, clear, or display breakpoints. Each applies to an individual breakpoint, except BA which indicates all breakpoints. Examples include:

BA+ enables all breakpoints
BM- disables memory breakpoints
BB* clears all byte breakpoints
BA? displays all breakpoints

The M command is used to move a block of memory from one location to another. It checks for overlap before carrying out the relocation and automatically moves backward to prevent data loss. This can be useful when creating a

program under RUN to move code up some number of bytes to make room for an additional instruction.

The S command searches for a hex or ASCII string in memory. The SA option searches for references to an address. SU searches for assembly language instructions; it invisibly disassembles each line, then compares the line with the specified operand. An example of its use is:

SU CS:100 L300 "IN AL,DX"

Note that the opcode column must be exactly eight bytes wide if an operand is specified. A search for IN returns any occurrences of INC as well as IN.

As in DEBUG, the E command in Periscope enters hex data into memory. ES enters symbols into the symbol table. This can be used to breakpoint a location that does not have its own symbol. By first entering

ES 17BC:237 .TEST

the user later enters

G .TEST

to go and set a temporary breakpoint at that instruction, or

BC .TEST

to set a permanent breakpoint.

The R command displays a register and, when followed by a register name (RCX), modifies that register. RF displays the current flags and pauses to allow the user to modify them. To change to the zero flag, for example, the user simply types RF;ZR.

The F command fills memory with a specific byte value. The operand may be a hex value, a character string, or a combination (for example, "test",D,A stores the ASCII string test, then a hex carriage return and line feed).

Hex arithmetic is performed with the H command. The I and O commands input and output values, respectively, to a port. The screen is cleared with K, which is most useful when combined with other commands. For example, K;D clears the screen and dumps memory, which is preferable to the simple scrolling that is accomplished with D. Disk I/O is supported via an L command to load and a W command to write. Both support either absolute disk sectors or named files. The N command places a file name in the default file control block and text buffer.

Two kinds of tracing are supported: T (similar to the T command of DEBUG) executes a single instruction; J jumps over CALLs and INTs while tracing by automatically setting a breakpoint at the instruction that follows the CALL or the INT. Thus, it can run at full speed. Periscope switches back to the application's screen during each T or J command so that screen updates are recorded. The user can bypass the screen updates by using TN or JN.

If Periscope is set for a register window (see the description of windows below), the T and J commands produce only one or two lines—the instruction line and an optional memory reference line—and do not display the registers along with the instruction. As a result, more traced instructions can fit on a screen. However, this also makes it more difficult to follow changes made to the registers because they are updated in a fixed location, not scrolled with the instructions.

The Q command is used to quit Periscope. It returns the user to the application screen and displays a two-line window that includes the following options: (B)ooot, (C)ontinue, (D)ebug (or return to Periscope), (S)hort boot, and (Return to DOS. Return to DOS is applicable only in programs that were loaded with the RUN command. The user also can specify these options in conjunction with Q: QB quits and reboots; QC quits Periscope but continues execution. Note that QC differs from



There's only one winning card in the PC Acceleration Game.

The 286 Express Card™ from PC Technologies

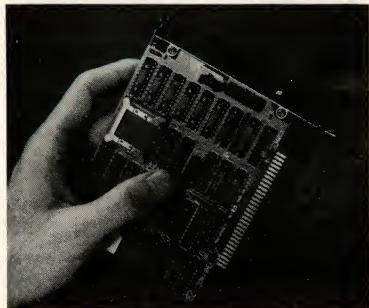
The 286 Express Card™ is unlike any other PC accelerator board. Why? Because it not only gives you all the advantages of a high-performance accelerator, but it also happens to be the original half-slot card. With a price tag too good to believe.

The design of the 286 Express Card is based on Intel's 80286 microprocessor — arguably the fastest VLSI processor in the industry. Designed specifically for the IBM PC and XT, the 286 Express is compatible with existing RAM, communication and peripheral cards, as well as most popular PC DOS software — with no software overlays or modifications required.

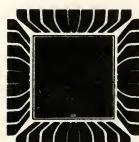
The 286 Express Card is loaded with value-added features, including 8KB of cache memory, DMA compatibility, the ability to use the memory on your motherboard and add-on memory cards. An optional 80287 floating point co-processor that works to accelerate the latest versions of spreadsheet and database software. And enough power to speed up your software programs — custom or off-the-shelf — anywhere from 200% to 600%.

Yet despite all that, the card measures just 5" (120mm). And retails for the low price of \$795.

Why gamble with PC productivity? To order — or for the name of the dealer nearest you — call PC Technologies today at 800-821-3086 ext. 100. And let us deal you the winning card.



704 Airport Blvd.
Ann Arbor, Michigan 48104
313/996-9690 • 800-821-3086
Telex 503589



RCT
PC Technologies Inc.

IBM, IBM PC and XT are registered trademarks of International Business Machines Corporation.

CIRCLE NO. 241 ON READER SERVICE CARD

PERISCOPE

the G command because G sets code breakpoints and QC does not.

Translation between decimal and hex is accomplished with the X command; X and XH take a hex operand; XD takes a decimal operand. The result of all three is a line showing the hex, decimal, binary, and ASCII equivalents of the operand. XA adds a segment and offset, producing a 20-bit absolute address. Neither symbols nor arithmetic can be used as part of any X command.

Like DEBUG, Periscope has a U command to unassemble. Because of the added convenience of symbols, Periscope's unassembled code is more readable than that produced by DEBUG. The US command interleaves lines of source code from a high-level language program with the disassembly. (See figure 1.) To retrieve the number of the lowest line in a program that generated code, the user types an *a* then presses F8. This displays all symbols that start with the letter A. In figure 1, line 36 and its symbol A36 were first in the program to meet this criteria.

Segments in the symbol table are relocated with the /S command. This is useful when symbol support is needed to debug a resident routine. The process is performed in three steps: the routine RUN.COM loads the symbol table (RUN.COM also loads a second copy of the routine into higher memory); /S changes the segment offset from the program loaded by RUN.COM to the resident copy of the same program; and QR, typed at the Periscope prompt, returns the user to DOS without executing the new copy of the routine. After these steps are executed, symbols that reference the resident routine are available for pushbutton debugging.

An optional user exit is possible with the /U *nn* command, which passes *nn* to the user routine in AH. A user exit must be loaded before Periscope and is invoked by using PS.COM and specifying the software interrupt used to access the routine. For example,

PS ... \U:60...

is used to specify that interrupt 60 (hex) is the user exit routine.

CUSTOMIZED SCREEN

With Periscope, the user can customize the screen, setting aside lines to display registers, stack contents, and other pertinent information. The /W command changes the Periscope windows; available operands include: R, which shows a register window; D:*nn*, which shows *nn* lines of data; S:*nn*, which shows *nn* lines of stack; and U:*nn*, which shows

nn lines of unassembled commands. Remaining space on the screen is scrolled as commands are entered.

Periscope uses the function keys to good advantage. Keys F1 through F3 retain their DOS definitions and perform line editing. F4 copies the remainder of the previous command line and adds a carriage return. This is particularly useful, because it allows the user to reexecute a command. F6 toggles a pause on/off switch that halts Periscope when a single command (such as a long dump) fills the screen. F7 displays the current record definition names, and F8 displays the current symbols (if these records are more than one screen in length, the user can use F6 to pause from screen to screen while the records are being displayed). Keying in one or more letters of a command before pressing F8 restricts the symbol display to only those symbols that begin with the specified prefix. F10 switches between the Periscope screen and the application screen.

Command combinations can be built with semicolons used as separators. For example, K;U clears the screen and unassembles the next screen full of code. A second example, BR CS NE

Good technical support is another advantage of the Periscope software. The program's author answers all support calls himself.

CS;GT, is more involved. This command remembers the current code segment (say F000) and begins running in monitored breakpoint mode until the code segment no longer matches the value of the code segment at the time the command was executed. In other words, this command runs until the code segment changes. It is useful for skipping segments that are of no interest and gives control to Periscope when the code segment returns to the program being debugged. If the new code segment still is not what the user desired, another press of F4 will reexecute the command until the code segment changes again.

Periscope provides some keyboard macro capacity for the function keys. An Alt-function key sequence assigns a command line to a key, and a Ctrl-func-

tion key replays the command. These function key definitions can be included in the record definitions file.

The debugger is easily installed. The user simply selects the appropriate memory address and ports for Periscope (the defaults are adequate for most users), plugs the memory and breakout board in a vacant slot (or inserts the breakout button lead for Periscope II, which requires no slot), and executes PS.COM. Some users may prefer to invoke the resident software from their AUTOEXEC.BAT files.

Submarine's 16KB of protectable memory may be installed at any 16KB memory boundary. It defaults to paragraph C000 hex, which is usually available. A conflict exists with the IBM Enhanced Graphics Adapter, which uses this memory address. Other boards, such as the Amdek Multiple Adapter Interface (MAI), also conflict. Running Periscope at paragraph B400 avoids the MAI conflict. Similarly, the port address that protects and unprotects the memory can be configured; it defaults to 300H and 301H, which is the address IBM reserved for prototyping boards.

Periscope II does not include the memory board. As a result, its installation involves only the breakout button. First, a ring terminal is placed under the retaining screw of an expansion board to connect it to ground. Then, a small bent wire is pushed between the gold finger on an expansion board and the board socket to connect it to bus pin A1. This allows the remote breakout switch to generate an NMI without taking up space on a board slot.

Good technical support is another advantage of Periscope. The author of the program answers all support calls himself. He was most helpful throughout the long period of review that preceded this article and was open to suggestions for improvements.

Periscope is a good product for the serious program developer. Less expensive symbolic debuggers and more powerful hardware debuggers are available, but Periscope's diverse features, affordable price, and portability place it in a class by itself.

Periscope I, \$295; Periscope II, \$145

Data Base Decisions

14 Bonnie Lane

Atlanta, GA 30328

404/256-3860

CIRCLE 345 ON READER SERVICE CARD

Ward Christensen invented the XMODEM file transfer protocol. He has been working with symbolic debugging since 1978.

se Framework II

Hayes

Hewlett-Packard
LaserJet

SS Token Ring

Microsoft
Word

3+

Wordstar
2000

Epson

Xerox

NEC

AT&T

AppleTalk

Finally, a network th

Thanks to 3+.

The multi-user PC network operating system that conforms to all the standards. And plays all the greats.

So you can build a network any way you want. Because 3+ implements the Microsoft Redirector, PC/MS-DOS 3.1 and more. To deliver true multi-user file sharing.

In fact, 3+ gives you everything DOS 3.1 does. "Plus" a whole lot more.

Such as internetworking. To link multiple local area networks over ordinary phone lines.

And remote PC access. So you can use the network even if you're working at home or on the road.

Electronic mail, too. To send information to any user on any of your networks. Whether they're across the building—or the country.

And if you have an IBM mainframe, get our 3+3270 and you're into the corporate data bank.

We could go on. But you get the idea. The 3+ family is the most complete and compatible network operating software you can buy.

systems

IBM

Ethernet

ALLOY

COMPAQ
Deskpro

dBASE III
PLUS

MultiMate

STARLAN

Symphony

Okidata
Microline 193

R:Base 5000
Multi-User

3Server

Lotus 123

at plays all the greats.

In fact, there's only one other thing you'll want. A way to manage your network communications, files, printers and backup.

We have that, too. In our 3Server family of dedicated network servers. Each delivers maximum network performance for 5 to 50 users. Or, thanks to 3+ versatility, you can use PC ATs or compatibles.

Best of all, 3+ is brought to you by 3Com. The most experienced supplier of PC networking products. With the largest installed base of PC networks in the world.

So why settle for half a network solution? Or a proprietary approach that locks you into a dead end?

See your nearest 3Com dealer instead. For the name and address of the one nearest you, call 1-800-NET-3Com.

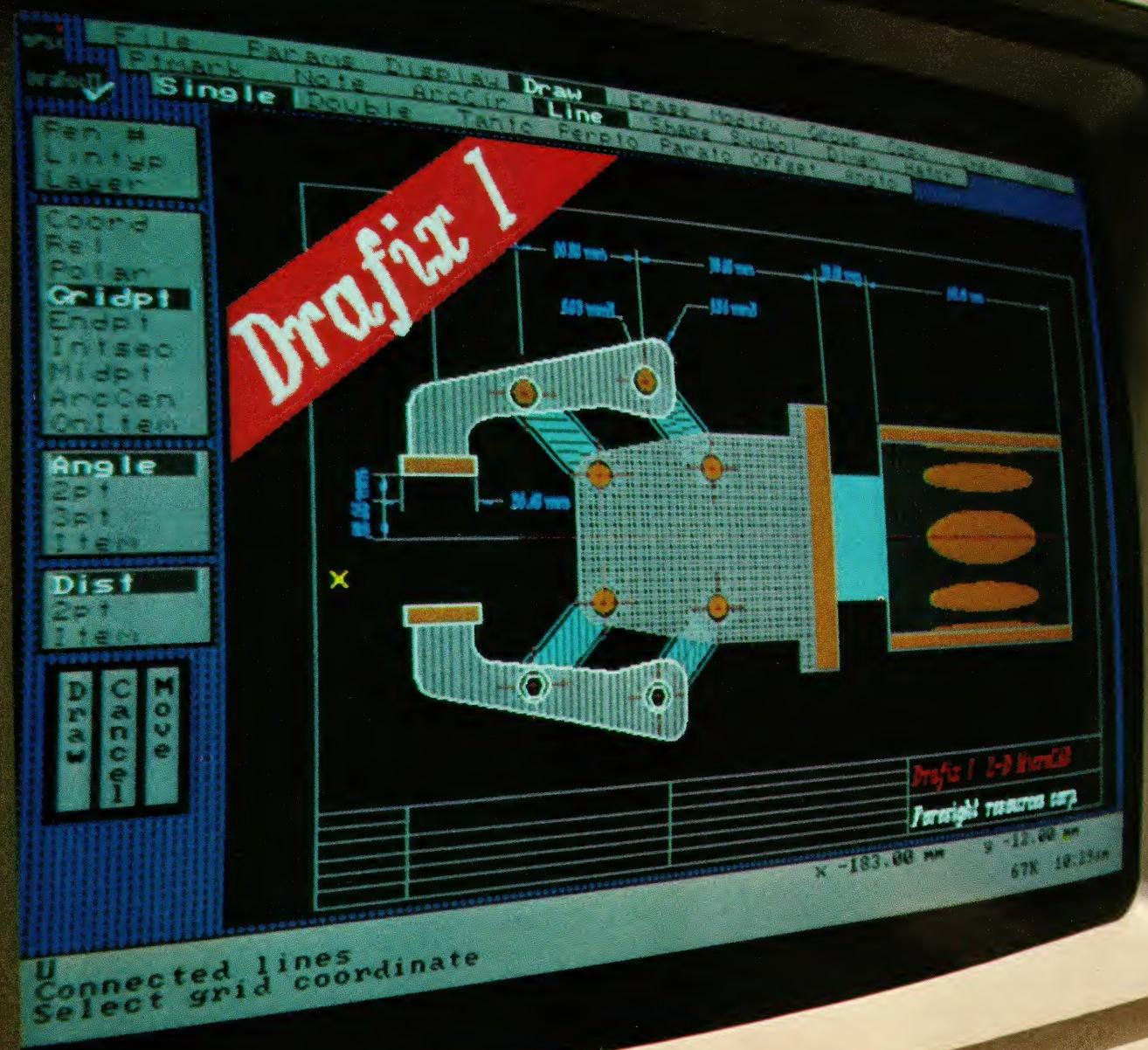
Because in networking, there's only one way you can have it all.

3Com®

CIRCLE NO. 186 ON READER SERVICE CARD

Epson is a registered trademark of Epson America, Inc. AT&T is a registered trademark and STARLAN is a trademark of AT&T. I23 and Symphony are registered trademarks of Lotus Development Corp. Okidata and Microline are trademarks of Okidata, an OKI AMERICA Company. NEC is a registered trademark of NEC Corp. AppleTalk is a trademark of Apple Computer, Inc. R:BASE Series is a trademark of Microm, Inc. TEAM-UP is a trademark of Unlimited Processing, Inc. Higgins is a trademark of Conetic Systems, Inc. The Bernoulli Box is a registered trademark of IOMEGA Corp. Great Plains is a trademark of Great Plains Software, Inc. DataFlex is a trademark of Data Access, Inc. Power-base is a trademark of Powerbase Systems, Inc. PROGRESS is a trademark of Data Language Corp. Diablo is a registered trademark of Xerox Corp. 3Com is a registered trademark and 3+ and 3Server are trademarks of 3Com Corp. EasyPlus and SuperProject are trademarks of Computer Associates, Inc. ©1986 3Com Corporation.

For \$295 you



can draw your own conclusions.

Drafix I. The first high performance CAD software everyone can afford.

Low-cost, high performance computer-aided design & drafting (CAD) software is finally available for use on your PC.

There's never been a professional CAD package so complete at such a low cost.

Drafix I from Foresight Resources. Only \$295.

Powerful, full-featured second generation CAD software.

Drafix I offers all of the capabilities you expect to find in packages costing \$2,000 or more.

This is not simply a souped-up paint package. Drafix I is a breakthrough in design that organizes sophisticated CAD functions into smooth, fast operations. All of the drawing, designing and editing functions that designers demand from a serious CAD tool are included in Drafix I.

A breakthrough in screen design and visual user interface.

Drafix I features the best organized screen design ever devised. Very simply, it displays all the information you need, all of the time.

The entire menu hierarchy is displayed constantly. There's no need to memorize commands or search for menus.

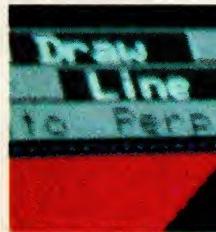
Snap-mode options are continually shown on the left screen border and can be selected "on the fly" by either pointer device or a single keystroke. Roll-down screens provide quick access to the virtually unlimited drawing, display and editing options.

And it's all controlled by a versatile three-button mouse, or digitizer, with on-screen prompts so each button function is clearly defined.

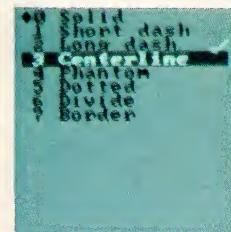
AutoCAD® compatible for easy expansion.

If you or someone in your company already uses AutoCAD, Drafix I offers an inexpensive way to add to your capability.

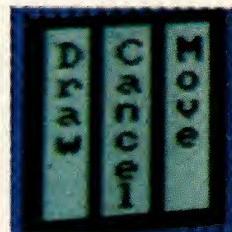
The optional Drafix I/AutoCAD file exchange utility permits transfer of drawings between Drafix I and AutoCAD.



Entire menu hierarchy visible at all times.



Extensive use of roll-down menus.



On-screen prompts define each mouse button function.

It's the perfect, low-cost alternative for increasing your drafting and design capacity.

Low introductory bundle prices.

Drafix I is designed to run on the IBM PC/XT/AT® and compatible personal computers. It supports all major graphics display cards, monitors, printers and plotters.

And to get you up and running we offer two special bundles — all the equipment you need at introductory prices you won't believe.

Get Drafix I with your choice of the Mouse Systems' PC Mouse® or Torrington's Manager Mouse® for just \$395.00. Or get Drafix I with SummaSketch 12" x 12" digitizer tablet with stylus for just \$585.00.

Order today. Take advantage of our 30-day, money back guarantee.

We're so certain you'll like the performance and versatility of Drafix I you're welcome to try it risk free for 30 days. If you're not completely satisfied, return it to us for a full refund.

Find out just how good CAD software can be. For only \$295.00.

Use our toll-free number and any major credit card to order your copy of Drafix I today.

SPECIFICATIONS

Code specifications

Lattice "C" language
Halo graphics
Floating point database

Coprocessor support
PC-DOS/MS-DOS 2.1 or later

Drafix I Features

Items

Lines
Pt markers
Arcs & circles
Note text

Polygons & ellipses
Polyline individual & nested

Item attributes

16 pen colors
255 Layers

8 Lineypes

12 Text fonts

32 Pt marker types

Screen Display

Zoom/Pan/Full

8 Save Views

Slide save/view

Grids on/off

Metric & English Standards

Engineering (decimal/fractional)

Architectural (ft in)

Project drawing info.

Numeric input

Keyboard and cursor

Absolute, Relative, Polar

Snap Modes

Gridpoint

Endpoint

Midpoint

Intersection

On item

Quadrant

Tangent

Arc center

Transform/Copy

Move

Rotate

Scale

Mirror

Align

Modify/Edit
Attributes
Break/Divide
Filled/chamfer
Trim
Stretch
Erase
Explode symbols & polygons
Mask
Replace
Merge
Region select
Workgroup

Auto hatching, polygon fill

Auto Dimensions

Linear Hor/Ver/Aligned

Angular

Di/Radius

Leader Notes

Ordinate

Chain & Baseline

Check calculations

Coordinates

Distance & angle

Area & perimeter

Item Masking

Hardware

Computers

IBM PC XT/AT and compatibles

AT&T 6300 Plus

Zenith

System Requirements

— 512K RAM

— RS-232 Comm port

— Mouse or digitizer

— Coprocessor recommended

Graphics Display boards

IBM CGA/EGA and compatibles

Hercules, and a wide range of graphics boards

Digitizers & Locators

All popular locator devices supported

Plotters

All popular plotters ("C" size) supported

"E" size plotter option available

Printers

All popular laser and dot matrix printers supported

Order Now! Call Toll-Free! **1-800-231-8574**, Ext. 500

Drafix I CAD Package \$295

Drafix I with Mouse \$395

Mouse Systems _____

Torrington _____

Drafix I with SummaSketch tablet \$585

AutoCAD File Exchange Utility \$ 95

Check, money order, Visa and MasterCard accepted

Dealer inquiries welcome

FOR E S I G H T

RESOURCES CORP.™

932 Massachusetts

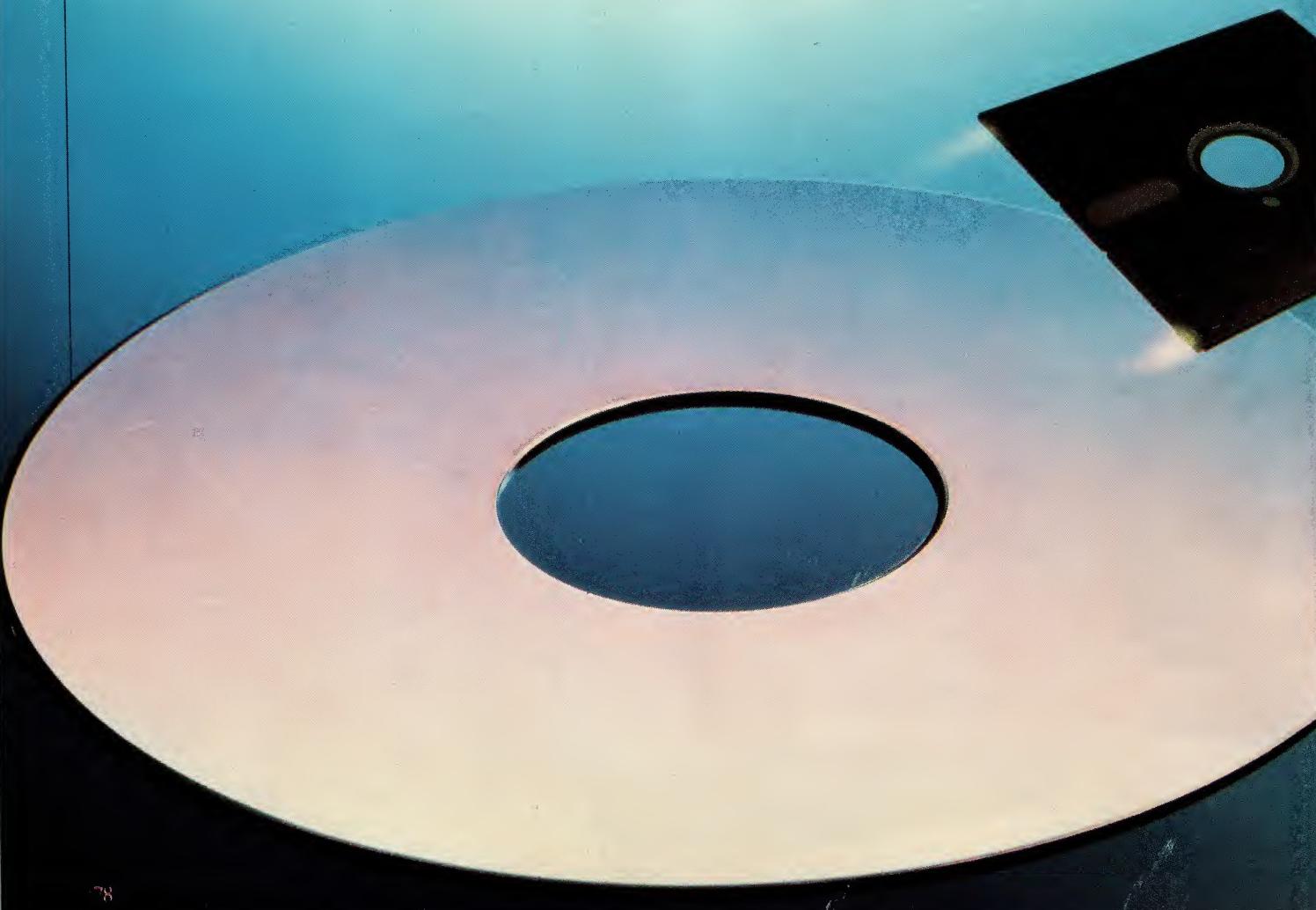
Lawrence, KS 66044

913/841-1121

Backup Utility Performance

STEVEN ARMBRUST and TED FORGERON

The task of backing up hard-disk files can be eased with an inexpensive software solution. Backup utilities are faster and offer more features than DOS BACKUP and RESTORE.





You can pay me now or you can pay me later," says a mechanic on a television commercial for automotive air filters. Buy a little preventive maintenance now, the mechanic advises, or you'll probably end up paying a bundle for repairs later. The message applies equally well to the hard-disk owner: he can spend a little time and money regularly backing up his hard disk, or he can spend a lot of time (and possibly money) attempting to recover from a fatal crash later.

Of course, tape backup units provide a fast and safe method of backing up a hard disk (see "Moving up to Tape," Steven Armbrust and Ted Forgeron, *PC Tech Journal*, November 1985, p. 62). But for the user who has just stretched his budget in order to buy a hard disk, or who has dug even

deeper for an enhanced PC/AT, there may not be enough spare change left for an expensive tape drive.

Before resigning himself to using the standard DOS BACKUP and RESTORE commands, he should consider purchasing one of the special-purpose, hard-disk backup utilities now available. These utilities back up hard-disk files to diskettes, just like BACKUP and RESTORE, but they offer more features and faster operation. They still require swapping diskettes in and out of a drive, but considering the speed of some of these programs and the added capacity of the 1.2MB AT disk drives, the user may find that backing up data is not as odious as expected.

Five of the hard-disk backup utilities currently available are: BAKUP from Software Integration, Inc., DSBackup

from Design Software, Dump/Restore from Cogitate, Inc., Fastback from Fifth Generation Systems, and BackTrack from Tallgrass Software Technology. (BackTrack, formerly known as Gemini Backup, was renamed when the developing company, Gemini Software, was purchased by Tallgrass Technologies Corporation.) An overview of their features is listed in table 1.

Among the five programs tested here, three distinct modes of operation were found. Fastback and Dump/Restore are command-oriented. Fastback is invoked by typing either FASTBACK (to back up) or FRESTORE (to restore). The user is then asked a series of questions about the files that are to be backed up or restored. Dump/Restore consists of several programs that can be used individually for special pur-

BACKUP

poses, such as displaying a tree structure of a disk's directories or setting file attributes, or combined in batch files to provide a full-featured backup utility.

Both BAKUP and DSBackup offer full-featured menu operation that greatly facilitates their use. Both also can be invoked from the command line. This permits setting up batch files to automate the backup process.

BackTrack offers the most unusual method of operation: although backup operations can be started from a menu, just like BAKUP or DSBackup, BackTrack is memory-resident. This allows it to perform backup operations in the background. Whenever the user stops typing for a few seconds (15 seconds at the DOS prompt or 60 seconds within another program), BackTrack activates and starts backing up any new or changed files automatically. When typing starts again, BackTrack stops and becomes dormant again.

Having a backup program work automatically in the background is a novel concept, but it does not work with BackTrack. Theoretically, backups are painless because they happen all the time, even while the user works on a Lotus 1-2-3 spreadsheet or dBASE III program. In reality the pain is merely shifted. While using BackTrack in automatic mode, one of the PC's floppy-disk drives must be dedicated to it. If the drive is needed for some reason, BackTrack's operation first must be suspended. If the user forgets and switches disks anyway, BackTrack will report that the wrong disk is in that drive.

A good reason for buying any backup program is the improved performance it offers over the standard DOS BACKUP and RESTORE. If it does not offer better performance, why bother? (Perhaps the user interested in the background operation of BackTrack would be willing to put up with lesser performance, because the backup happens in spare time anyway. But for the others, high performance is the key.) Table 2 lists performance benchmarks for the five programs. The DOS 3.1 BACKUP and RESTORE programs were included for comparison.

The tests were run on an enhanced AT with a 20MB IBM hard disk and an XT with a 10MB IBM hard disk. Both PCs included 640KB of RAM and were running DOS 3.1 with BUFFERS=20. The AT hard disk contained 1,859 files in 62 directories. The XT hard disk contained 834 files in 28 directories. The AT backups were performed using 1.2MB floppy disks; 360KB floppies were used with the XT.

TABLE 1: Features Comparison

	BACK-TRACK	BAKUP	DUMP/DSBACKUP	RESTORE	FASTBACK
Version number tested	1.75	3.04.2	2.2 ^a	1.04	5.02
Product copy-protected	Yes	Yes	No	No	Yes
Command-oriented operation	Yes	Yes	Yes	Yes	Yes
Full menu-oriented operation	Yes	Yes	Yes	No	No
Operates from batch file	Yes	Yes	Yes	Yes	Yes
Tracks incremental backups	No	Yes	No	No	Yes
Estimates number of diskettes	Yes	Yes	Yes	No	No
Estimates backup time	Yes	Yes	No	No	No
Verify switch included	No	Yes	Yes	Yes	Yes
Read verify included	No	No	No	Yes	Yes
Write verify included	No	Yes	Yes	No	Yes
On-line help provided	Yes	Yes	Yes	No	No
Generates printed reports	No	Yes	Yes	No	No
Uses DOS disk format	Yes	Yes	Yes	Yes	No
Compresses files on diskette	No	No	Yes	Yes	Yes
Formats diskette during operation	Yes	No	Yes	No	Yes
Re-use diskettes without reformatting/deleting files, directories	No	Yes	Yes	No	Yes

^aDesign Software has released version 2.4 of DSBackup; it was not available in time for this review.

All of these backup utilities provide similar functionality. One standout feature is the incremental backup catalog that is offered by both Fastback and BAKUP.

Full backups were done on both systems. For the AT, times also are shown for an incremental backup and restore of 500KB of files. Times for full restores are not given because in actual use, full restores are rare. Moreover, most of the time used in a restore operation is the overhead DOS adds in creating files and directories.

As table 2 shows, Fastback is the performance winner, executing full backups on the AT and XT in less than half the time of its nearest competitor. Its performance is poorer the first time it is run because it uses a nonstandard disk format and must format the diskettes before it can use them. However, once a set of Fastback diskettes is available, even some that contain old data, Fastback can proceed at the speeds that are indicated in the table.

Fastback's performance looks good even when compared to several of the tape backup units on the market. In "Moving up to Tape," backup times are listed for several popular .25-inch cartridge tape drives. Granted, a different (and slightly smaller) set of data was used for backing up to diskette, but Fastback's time of 10:55 seconds for a 10MB backup makes it considerably faster than tape drives such as the Adic Model 552 and Alloy PC-QICTAPE, and puts it about on a par with the Tallgrass 4060. Quite an achievement for a product that lists for approximately one-tenth the cost of a tape drive.

Of course, tape drives offer other advantages, such as unattended operation and error detection and recovery. But Fastback also offers the user a data detection and correction feature.

TABLE 2: Performance Benchmarks

DOS		BACKUP/ BACK- RESTORE TRACK	BAKUP	DS	DUMP/ RESTORE	FAST BACK
FULL	10MB PC/XT BACKUP (sec)			BACKUP	BACKUP	RESTORE
FULL 10MB PC/XT BACKUP (sec)	66:15	44:26	36:15	25:05	69:45	10:55
Number of 360KB diskettes	26	26	24	23	19	23
FULL 20MB PC/AT BACKUP (sec)	80:17	86:55	45:03	23:37	70:30	10:34
Number of 1.2MB diskettes	17	16	16	15	14	16
500KB AT BACKUP (sec)	01:10	00:50	00:34	01:30	01:56	00:24
500KB AT RESTORE (sec)	00:40	01:05	01:46	00:36	04:03	00:35

Clearly, Fastback was the fastest backup utility reviewed. Fastback uses two DMA (direct memory access) channels simultaneously to transfer data between the hard disk and the floppy, a method that is also employed by high-speed tape drives.

Fastback achieves its high performance using a technique that could cause problems with older PCs. It uses two DMA (direct memory access) channels simultaneously to transfer data between the hard disk and the floppy, a method also employed by high-speed tape drives. One DMA channel is used to transfer information from the hard disk into a memory buffer. At the same time, another DMA channel is used to empty the memory buffer and transfer the information to the floppy disk.

Although this simultaneous DMA process improves performance greatly, it will not work on a small percentage of older IBM PCs that contain defective 8237 DMA chips. The defective chips function correctly in normal operation, where only a single DMA channel is used at any one time. But when two or more DMA channels are used at once, timing problems prevent the proper transference of data.

Fifth Generation Systems acknowledges that this hardware problem does hinder some users of its product. But rather than slow down Fastback by using just a single DMA channel (even though it has a /SLOW option that does just that), the company offers a circuit board, sold separately for \$40, that corrects the problem. The board plugs directly into the PC's 8088 socket, so as not to take up any expansion slots. Questions concerning difficulties should be addressed to the company.

All five programs tested offer a similar range of backup and restore options. The programs can back up and restore an entire disk, selected directories, or selected files. They also can

do incremental backups; that is, backing up only those files that have changed since the last time a backup was done.

Incremental backups make lengthy backups tolerable. Instead of making a complete copy of the hard disk at every backup, a complete copy is made occasionally (once a month, for example). The rest of the time, incremental backups are done. For most users, this cuts the daily backup task down to a two- or three-minute job.

Unfortunately, with most backup systems (tape systems included), organizing and maintaining the set of

If the backup utility uses DOS-formatted diskettes and the DOS file format, a file can be restored using the DOS COPY command.

backup data is left up to the user. He must keep track of which set of disks contains which daily backup because restoring the latest version of a file often involves starting with the last full backup and working in order through all the incremental backups. If disks or tapes are not labeled properly or otherwise become mixed up, it may be difficult (if not impossible) to reconstruct the file system.

Two of the utility programs, BAKUP and Fastback, offer a better way of orga-

nizing the incremental backup disks. Instead of forcing the user to keep track of each set of incremental disks, these utilities maintain their own catalog of files. The user simply labels the disks as indicated by the program. The program keeps track of which backup set a disk contains and where in the diskette set the latest version of each file resides. During a restore operation, both programs ask the user to insert the appropriate diskette.

DISK FORMATTING

An important element of backup programs is the disk format. If DOS-formatted disks and the DOS file format are used, a file can be restored using the DOS COPY command, even if a bug in the backup program or some other catastrophe (such as the destruction of the sole copy-protected version) prevented the backup program from working. It may require searching through obscurely named directories on the backup disks, but it would be possible. BAKUP and BackTrack produce their backup disks using pure DOS files.

On the other hand, backup utilities can benefit by not using the pure DOS disk and file format. DSBackup and Dump/Restore, for example, use file compression techniques that minimize the number of diskettes needed.

Fastback takes the process one step further by using its own disk format. This nonstandard format not only compresses the data, but it also adds an error-correction capability. This allows Fastback to recover as many as 80 bad sectors on a 360KB diskette (one per track on each side of the disk). This recovery is possible even if the disk is damaged after the backup is made.

Given that these utilities require DOS-formatted (or specially-formatted) diskettes, what happens if an insufficient number of diskettes has been formatted before the backup program is run? Four of the products offer a solution to this problem. Fastback formats its diskettes on the fly—no need to format ahead of time. BackTrack and DSBackup can do the same for DOS-formatted diskettes by letting the user stop, format more diskettes, and continue where he left off. BAKUP cannot format its own disks, but before it starts backing up, it gives an estimate of the number of diskettes needed. If the user does not have that number on hand, he can abort the program at once. Dump/Restore provides no estimates, nor does it permit the user to stop and format more diskettes.

Three of the utilities, BAKUP, DSBackup, and Fastback, accept scratch



Alloy's Streamliner Series. The best protection for your company's past, present, and future.

The best protection for your personal computer data storage needs is available today. From Alloy. Choose tape only. Or combined disk and tape. Either way, the Streamliner Series provides the performance you expect from the leader. At a remarkably affordable price.

Alloy's FT-60 streaming tape backup subsystem gives you up to 60Mb storage capacity and high-speed data transfer. The SL-60 models give you the same high quality tape unit *plus* integral hard disk. And you can choose 20Mb or 41Mb formatted data capacities.

With Alloy's Streamliner Series, you'll get the best protection for your company's past, present, and future. So call Alloy today at (617) 875-6100.

ALLOY
Computer Products, Inc.

100 Pennsylvania Avenue, Framingham, MA 01701 (617) 875-6100, TWX 710-346-0394
In Europe: ALLOY Computer Products (Europe) Ltd., Cirencester, Gloucestershire, England. Tel.: 0285 69571 Telex: 43340

CIRCLE NO. 231 ON READER SERVICE CARD FOR MORE INFORMATION

CIRCLE NO. 232 ON READER SERVICE CARD FOR SALESPERSON OR DEMONSTRATION

BACKUP

diskettes if diskettes are requested, and overwrite existing files. Dump/Restore and BackTrack require clean diskettes.

Programs such as these—programs that are needed in emergency situations—should not be copy protected. Nevertheless, three of the products reviewed here are so protected: BackTrack, BAKUP, and Fastback. Fastback uses the worst possible form of copy protection from the standpoint of a hard-disk user: it requires a key disk in drive A: every time it backs up. The restore program is not copy protected.

Included with Fastback is a form to fill out to obtain an unprotected version of the program. The form contains a list of 13 promises that collectively say, "I promise not to pirate the program." Not wanting to be in the key-disk-swapping business any longer than possible, the authors sent off their form immediately. Nearly a month later, a form letter arrived explaining that the unprotected version would cost \$25 more.

BAKUP and BackTrack use better copy-protection mechanisms that allow the user to install the programs directly on a hard disk. Both use a counter mechanism that permits a certain number of "installs" before the program cannot be copied further. They include an "uninstall" option to remove the program and increment the counter. But as convenient as these mechanisms sound, they still cause problems.

For example, BAKUP was reviewed on a new AT that had an unreliable 20MB hard disk; somehow, during the review, all of the installs were inadvertently used up. The documentation lists a telephone number for the user to call to receive instructions on how to get one more "emergency" install, but this call was made on the weekend and no one answered. Fortunately, BAKUP uses the standard DOS file format, so the damaged file was reconstructed using the DOS COPY command.

BUGS AND OTHER PESTS

Besides copy protection (which many software users regard as a bug), the tested versions of these programs contained a few other bugs.

BAKUP has a problem that seems to surface only when the catalog of files it maintains spans two diskettes; the problem became apparent in restoring an entire hard disk after reformatting it. BAKUP asked for the last disk in the backup set—the one that had the catalog. But the catalog was split across the last two diskettes, so BAKUP asked for the second-to-last diskette. Then it asked for the last diskette again. Finally

it gave up and displayed a message to the effect that the catalog was bad.

DSBackup has a minor problem in its installation process. The product's instructions tell the user to type the word **install** followed by the name of the directory onto which he wants the program to be installed. This process works satisfactorily if the directory that is specified by the user already exists. If, however, the directory does not exist, DSBackup does not create one. During the review, all of the DSBackup files ended up copied into a single file called DSBACKUP (the name that had been given for the directory). The documentation does not discuss the necessity of creating a directory first.

Dump/Restore had difficulty dealing with bad diskettes during backup.

BackTrack has an annoying quirk: during the installation process, the program adds many lines to the AUTOEXEC.BAT file.

In the course of one backup session, the program did not like the FAT on backup diskette number 8. However, instead of requesting a different diskette, it aborted the entire backup process. To correct the problem, a different diskette had to be used and the entire backup program started over from the beginning, with diskette number 1. This cost more than 36 minutes of additional backup time.

BackTrack has a quirk that really cannot be called a bug, but it is annoying just the same. During installation, the program adds lines to the AUTOEXEC.BAT file. The documentation mentions what will happen, but the program does not give the user the option to edit the AUTOEXEC.BAT file. A user who is very careful about the contents of his AUTOEXEC.BAT will not appreciate programs fiddling around in there without his permission.

The first version of Fastback used, version 5.0, had a couple of serious bugs that begged the question as to whether this program, despite its speed, was worth considering. But version 5.02, the program used for evaluation in this article, corrected all the bugs that were found. Users with earlier versions should upgrade to version 5.02 or later.

RELATIVE COSTS

These programs range in price from \$69 to \$180, which is not much when compared to \$1,000 and \$2,000 tape backup systems. Still, in comparison to other utility software programs, they all seem a bit overpriced. If Borland International can sell SideKick for \$85, Reflex for \$99, and Turbo Pascal for \$70, then these backup programs are more sensibly priced in the \$50 range. At that price, almost every hard-disk owner should consider one.

A few of these backup utilities offer excellent performance; the most unfortunate aspect is that they are also copy protected. Certainly, the overall winner is Fastback, a program with speed and error-correction capabilities unique among the products reviewed. Fastback maintains a catalog of incremental backup disks, as does BAKUP, which also is worth considering. Though somewhat slower, BAKUP offers a nice menu-driven interface. Both are usable alternatives to hardware backup systems.

BackTrack 1.75: \$179.00
Tallgrass Software Technologies
91 Sheldon Street
Providence, RI 02906
401/274-0393

CIRCLE 356 ON READER SERVICE CARD

BAKUP 3.04.2: \$179.95
Software Integration, Inc.
9800 S. Sepulveda Blvd., Suite 214
Los Angeles, CA 90045
213/776-3406

CIRCLE 357 ON READER SERVICE CARD

DSBackup 2.2: \$69.95
Design Software, Inc.
2 N. 520 Prince Crossing Road
Suite 16
West Chicago, IL 60185
312/231-4540

CIRCLE 358 ON READER SERVICE CARD

Dump/Restore 1.04: \$129.95
Cogitate, Inc.
24000 Telegraph Road
Southfield, MI 48034
313/352-2345

CIRCLE 359 ON READER SERVICE CARD

Fastback 5.02: \$179.00
Fifth Generation Systems
7942 Picardy Avenue, No. B-350
Baton Rouge, LA 70809
504/767-0075

CIRCLE 360 ON READER SERVICE CARD

Steven Armbrust is a freelance writer. Ted Forgeron is a microcomputer software consultant. They work primarily in the Silicon Forest near Portland, Oregon.

PC BRAND: CAREFULLY CHOSEN TOOLS FOR PROGRAMMERS,

LIBRARIES: to Speed Programming

You cannot go wrong buying any or all of these compendious compilations. So cost effective that use of just a few will save a bundle compared to writing your own.

LATTICE C-FOOD SMORGASBORD

Decimal Arithmetic: Trigonometric, logarithmic functions, powers, conversion to strings, BCD operations for numbers up to 16 significant digits.

Level 0 I/O Functions: Direct operations for screen, keyboard, printer, and asynch port to minimize memory usage and maximize speed.

IBM PC BIOS Interface Access: Gets basic I/O services in ROM BIOS not available from the operating system to get and set keyboard modes, printer port status, video attributes and cursor positioning.

Terminal Independence Package for transport to other types of terminals.

Product Code: S0200 PC Brand: \$150.00
List Price: \$109.00

GREENLEAF FUNCTIONS

New 3.0 has 225 functions in both C and assembler source as well as library format. We have versions for Lattice, Microsoft, C86, Mark Wms. New emphasis on tighter functional groupings to minimize excess baggage of functions loaded whether used or not. Manual's 250 pages now help select functions, as do demos and bulletin board.

32 DOS extensions: file and directory manipulation for DOS 1.1 and 2.0.

23 Screen Functions: Select mode, page,

monochrome or color, palette; cursor shape, positioning; clearing and scrolling; pixel get and put; read light pen.

60 String Functions: Manipulation of strings including center and justify; efficient list operations which add, delete, and sort pointers to strings for top speed.

50 Graphics Functions: Primitives to access all graphics; typeface, formatting, and forms control.

Plus keyboard status and function key assignment, time and date algorithms . . . we could go on!

Product Code: S0770 PC Brand: \$139.00
List Price: \$185.00

GREENLEAF COMMUNICATIONS

Want your application to communicate with other users or remote date bases? Now you can build asynchronous communications right into your C programs!

Over 60 functions and demo programs in both C and assembler source code set up an interrupt driven scheme with separate transmit and receive ring buffers for an arbitrary number of ports. Interrupt control means you can download a record, then halt the incoming stream to file it, display it, let the user tamper with it, send it back up line. Goodbye separate communications software.

Supports ASCII or binary, any parity, any word length, 8250 UARTs, all four Lattice C memory models, Hayes 300, 1200, 1200B and other modems.

Its 80-page manual has examples of each function and guides you through asynchronous communications.

Product Code: S0750 PC Brand: \$139.00
List Price: \$185.00

BTRIEVE

Queen B-Tree File Manager Abdicates Royalties

This monarch of file managers has always been off-limits to programmers for whom royalties would ruin profit

PLINK86 & PLUS

Dynamic Cache Overlays Maximize Memory Use

Plink86™ long the overlord of overlay linkers, now has a Plus version. As a linker Plink can be used with any compiled language which delivers Microsoft/Intel format object files. It yields automatic symbol tables and more memory maps than DOS LINK, but its overlay power has won its reputation as a miracle worker. Plink86 shoe-horns large programs into small memory by binding into your compiled program an overlay manager which knows how to swap modules of large linked programs between disk and shared memory space. Plink86's straightforward overlay description language allows you to describe your overlay hierarchy in a structure permitting up to 4,095 overlays stacked 32 deep.

So if your program needs large chunks of memory, you no longer forego sales to folks who have less. But if you've assumed 128k, and they have 640k, Plink86-Plus™ knows to use extra memory as cache for overlays — at full speed compared to disk swapping. It also can automatically restore a displaced overlay to which a subsequently called overlay must return, and assign library modules to either a program's root segment or overlay areas.

Plink, the programmer's choice even when CP/M™ was the poobah of computing.

List PC
Code: Product: Price: Brand:
S0500 Plink86 \$395 \$289
S0499 Plink86-Plus \$495 \$359

margins. So it's quite a proclamation indeed that one need no longer pay a tithe to incorporate Btrieve™ in applications.

Btrieve is fully developed and fast. It takes complete charge of all file indexing, reading, writing, insertion and deletion. It builds 22 commands right into the language you use in the form of functions you call to tell Btrieve what to do. The commands create, open, and close files; delete and insert records; recapturing vacated space; find records which exactly or most nearly match keys; walk files by ascending or descending key.

Btrieve's foundation is a balanced-tree indexing scheme, conceded to be the fastest search technique devised (it will find any key in a million-plus item index in four or less accesses).

Btrieve comes with interfaces to C, Pascal, BASIC, and COBOL, and the manual gives you working sample programs which demonstrate every command in all four languages. The kind of presentation which led PC World to exclaim "for those of us who have endured poorly written and inadequate manuals, this one is a pleasure."

Btrieve has mainframe specifications! A single file may have up to 24 indexes. Segments of keys may be indexed. Each index can independently accept or block duplicate keys. A record length can be up to 4090 characters; an index length 255 characters. A file may be 4 billion bytes. It can even extend a file across two drives — even two hard disks!

With Btrieve you are freed to think logically; the physical file is no longer of concern. Gone for good is all that time-wasting dickerling with intricate file referencing schemes and sorting algorithms. Thinking shifts to a higher plane.

Product Code: S0650 PC Brand: \$199.00
List Price: \$245.00

C-SPRITE

Lattice's Debugger for Lattice C

We once called it a symbolic debugger, but Lattice® advances now bring your source code on screen for your viewing pleasure. Hand this versatile companion to your compiler a .COM or .EXE file and C-Sprite™'s source mode will display your original program statements during most operations — your function names, your variable names, your data types, and the line numbers from your source code. At any breakpoint you can disassemble the object code and see source and assembler intermingled on screen.

If inclined, you can as well view machine addresses and machine-coded instructions to scrutinize what the compiler (or an assembler) contrived. You can work with data in hex, of course, or specify C's data types to cause the debugger to display memory addresses as strings, long integers, etc., even pointers.

C-Sprite can set breakpoints using symbols or addresses. You can submit clusters of commands to be executed at the breakpoints, or set commands that execute until a condition is met. New features permit redirection of STDIN and STDOUT, display and alteration of 8087 status, the setting of pointer sizes, and a symbol table exceeding 64K.

C-Sprite even has macros. Use your source code variable names in a macro to dump the contents of entire C structures, for example. And you can debug through one of the COM ports with a second terminal so as not to disturb your program's display screen. What's more, if you link with Plink86, C-Sprite can even tackle overlays.

Product Code: L2300 PC Brand: \$149.00
List Price: \$175.00

BASIC_C

Use Your Knowledge of BASIC to Learn C

If you're getting the message that switching from BASIC to C would be prudent, you're about to discover that it's back to basics of a different sort. BASIC is fat with hidden functions that stripped down C just doesn't have.

Gone are all those handy string manipulators like LEFT\$, MID\$, STRING\$, etc. In C, when you reach for even simple invocations like INPUT or PRINT — well, underlying such expressions in BASIC are bulging macros which C cannot have if it is to keep its slim profile.

But now comes BASIC_C and all your old favorites are back. Over 80 routines to open and close files, field and perform conversions on file buffers, peek and poke, print using, clear screen, "instr", on error goto . . . they're all there. Some have re-worked names and syntax to suit C, but all are written as one-to-one functional equivalents to the familiar features of BASIC. And they are documented one to a page in alphabetical sequence like the Microsoft manual for added familiarity.

So with BASIC_C when you're thinking INPUT, go ahead. Use it. Or LPRINT or LOCATE or INKEY. But without BASIC_C, you will find that every line of code plunges you back in the C texts to figure out how to write it. Someday you'll want to, but for now, BASIC_C will start you programming quickly at the statement level so that you can concentrate on C's larger concepts.

Product Code: S0350 PC Brand: \$139.00
List Price: \$175.00

BASTOC

Translates BASIC to C

You'd like to upgrade C, but what to do with that warehouse of BASIC routines you've carefully polished over the years? And how to face converting your famous Leviathan accounting system from BASIC, much less your Labyrinth file management package?

Use BASTOC™ a translator which takes in BASIC source code and emits pure Kernighan & Ritchie C. Our BASTOC versions understand either Microsoft Extended BASIC or CBasic, with Lattice C as the target. They will optionally convert your program into a single monolithic C function or will decompose it into separate functions, one for each GOSUB label.

Strings are dynamically allocated in the target program, ridding your application of BASIC's catastrophic halts for garbage collection. BASTOC will try to create structure of even the most convoluted BASIC code, and writes any indigestible statement into the C output as a comment plus explanation. Also, you optionally can tell BASTOC to insert BASIC source lines into the C target as comments.

BASTOC comes with a runtime library for final link-up with compiled C output. Source code of those modules which contact the operating system is supplied so you can tailor BASTOC to your environment if needed.

Product Code: S0375 PC Brand: \$299.00
List Price: \$350.00

PANEL

Feature-Laden Screen Design Tool

The newest version of this premier programming tool lets you layer your screen designs with up to ten overlapping images, making it easy to background a screen with pop-up lists, help boxes, and alternate sets of input fields.

Writing your own screenware is a good way to blow completion dates and profits. Panel™ works with you interactively to set up foolproof screen displays and data entry forms rapidly. It tests your form to prove that it (and test data) behave correctly, then converts the finished work into C source code for incorporation into your application. Compile with Lattice or Microsoft.

Wonderfully diverse attributes may be selected for any field — size, data type, color, of course, but also conversion of input to upper case; clearance of existing data when new entry is started; masks for standard formats (eg, dates, phone numbers); a choice of styles for numeric fields; phrases which fill in when their first letter is typed; multiple-choice lists from which to choose a field fill-in by cursoring a highlighted bar. Fields may be multi-lined (eg, name and address as one field) and scrolled if larger than the screen space allotted them.

Panel builds in a user interface for keystroke movement within and between fields, and supplies extensive validation routines for checking user field entries — in source code, so you can tack on your own unique variants. Screen designs may be dynamically loaded from file, or compiled into a program, and version 6 has optimized code to quicken display speed.

The whole package is wrapped in a monitor and keyboard customization package to tailor your application for other equipment. Panel. A superior productivity tool no bigger than ever.

Product Code: S0400 * PC Brand: \$229.00
List Price: \$295.00

PRICED TO SAVE YOU MONEY, SHIPPED FAST ANYWHERE.

NEW
LOWER
PRICES!

RUN/C PROFESSIONAL VERSION

Interpreter Now Accesses Binary Libraries

RUN/C was an innovator for converting inaccessible compiled C to an interpreted language as easy to grab hold of as BASIC. Great for learning, but a problem remained for pros. An interpreter expects nothing but source code, and that put the vast resource of professional binary libraries off limits.

No longer: RUN/C Professional™ has the tools dynamically to load and unload multiple binary function libraries while in its interpreter. Your code can now reach for functions in the commercial C libraries like C-Food Smorgasbord™ - opposite - potentially any library compiled with Lattice's large model. How? The manual shows how to develop the interface to a library, using the Lattice compiler (a must!). How about your own archive of functions? No reason why not.

The RUN/C Interpreter

The interpreting engine lies at the heart of both the improved original RUN/C and the new Professional version. Its creators had the inspiration to make once formidable C behave on screen much like PC BASIC with a full-screen editor like WordStar®. Just create a program and RUN it. If it stumbles, LIST it, EDIT it, add lines, delete lines, RUN it again, fix it again. Use familiar commands like LOAD, MERGE, SAVE, FILES, even TRON and TRACE, and a free profiler.

RUN/C is ideal for rapid program development. Put up code at high speed, tinker and re-arrange, try out things devil-may-care, and let RUN/C find your typos and malaprops.

RUN/C has a treasury of functions built into the interpreter - over 100 paralleling the most used functions found in standard compiler libraries. So when and if the time comes to compile, your source code will find counterparts.

There are lots more features - system interrupts, a shell command to invoke any operating system command without leaving RUN/C, even the ability to load a preferred editor in parallel and switch back and forth.

RUN/C Standard Version

Straight RUN/C has all above but the Loadable Libraries™ docking module. It utilizes source code only, whether created by its own editor, or from any ASCII file, such as programs you've already written, or commercial libraries which supply source code.

It makes a splendid teacher. The manual has not just instructions how to use RUN/C, but its 500-plus pages provide a thorough-going demonstration of the C language itself. Every feature, of C or RUN/C, is accorded its

OUTSIDE U.S.?

The dollar is weaker. In your currency, our prices are lower than ever. PC BRAND ships anywhere. We'll prepare the export documents and ship to you or your agent by air freight, courier, or air parcel post. Pay by credit card or wire funds (see "Terms" below).

TERMS AND CONDITIONS OF SALE

Licenses: Each price is for a license to use a product on a single computer and does not constitute its ownership. We will inquire for you about site licenses. Except as otherwise indicated, products may be used to create programs for distribution without royalty payments or additional licenses, provided said programs do not substantially replicate the products themselves.

Compatibility: PC BRAND's standard products are designed to operate with the IBM® PC, XT or AT under PC-DOS and require no more than 128K of RAM unless indicated. Non IBM machines using MS-DOS - contact manufacturer.

Returns: Defective parts will be replaced. Products are rendered unreturnable if you open sealed envelopes containing diskettes. Otherwise, call for authorization to return a product for refund.

own micro-chapter. Over 100 of these chapters are devoted to RUN/C's built-in functions, and every one lists a sample program showing how it is used. The programs are also on the disks. So as you read them in the manual, you can run them on the screen. (Needs 180K-256K recommended.)

RUN/C Professional

RUN/C Pro has every feature of RUN/C regular plus the binary library link-up and an extra level of debugging aids. They are ingeniously installed behind a built-in function, so you can call for debugging conditionally. The called function paints a menu of debugging tools to choose from, including immediate mode to display variables, single-step tracing, and changing of variables.

RUN/C Professional can tackle projects of any size. Use it as a creative front end to feed a continuous stream of source code into compiled modules. Only the source work in progress is still interpreted; the finished modules will whiz by at object speeds. It will change how you work. (320k minimum and 512k recommended to fit libraries.)

RUN/C: quite a run for your money.

Code:	Product:	List:	PC
S0910	RUN/C	\$120	\$109
S0950	RUN/C Pro	\$250	\$199

Kernel has labored and come forth with the long-awaited Version 3.0 of its top-rated compiler. A long list of enhancements, adoption of the ANSI draft standard, documentation rivaled by few, and add-on libraries matched by none in sheer quantity restore Lattice C™ to its leadership role as the C compiler to beat.

Lattice now embraces key UNIX™ enhancements which have entered the language since Kernighan & Ritchie void functions returning no value, enumerated data types to assign stepped values to variables, the ability to pass data between structures by assignment statements. And 3.0 adopts checking of external function arguments by data type as proposed by ANSI to kill bug swarms when modules join up at link time.

The greatly expanded libraries, now comprising 325 functions(!), enable the file sharing and record locking provisions of DOS 3.1, provide a full complement of transcendental, and a host of utilities to mimic the UNIX and XENIX™ environments.

Lattice now delivers smaller .EXE files, curing one past complaint, boasts very fast link times and a more efficient aliasing algorithm.

The compiler now defaults to the ANSI proposed standard when you need a strict mistress, but command line options tolerate straying. New options generate

The GSS GRAPHICS SYSTEM A Standard Bearer with No True Royalties MAJOR!

Uplifting graphics tools usually come with backbreaking royalties. That's been too heavy a load for limited market or low-priced applications to bear. The GSS approach lifts this burden.

The GSS™ series offers a comprehensive set of programming tools adhering to all the major graphic standards. Indeed, its creators sit on a major national standards committee. (Crafty devils) They know that, more and more, your customers will be concerned for whether you followed standards to obviate obsolescence.

At the heart of the system must be the GSS-Drivers™ package, a library of interfaces between keyboards, mice, joysticks, tablets and printers, plotters, and cameras. It conforms to the proposed ANSI virtual device interface (VDI). Give it a generic request and it copes with the idiosyncrasies of the devices.

Then you have a choice of tools. First, VDI "bindings" for C and other languages are libraries of primitives with which your program can build graphic images. Each binding links to Drivers to form a working unit sufficient to produce graphics.

Productivity, though, begins with the GSS-Tools™ series. Each - Kernel, Plotting, or Metafile - is a library which wraps the bindings for all the supported languages with an envelope of intelligent tools.

Kernel knows how to drive the bindings primitives to draw and color an object, store the sequential instructions, and recreate the object on its own. So powerful,

LATTICE C VERSION 3.0

NEW RELEASE!

Major Upgrades to the Best Selling C Compiler

Lattice has labored and come forth with the long-awaited Version 3.0 of its top-rated compiler. A long list of enhancements, adoption of the ANSI draft standard, documentation rivaled by few, and add-on libraries matched by none in sheer quantity restore Lattice C™ to its leadership role as the C compiler to beat.

Lattice now embraces key UNIX™ enhancements which have entered the language since Kernighan & Ritchie void functions returning no value, enumerated data types to assign stepped values to variables, the ability to pass data between structures by assignment statements. And 3.0 adopts checking of external function arguments by data type as proposed by ANSI to kill bug swarms when modules join up at link time.

The greatly expanded libraries, now comprising 325 functions(!), enable the file sharing and record locking provisions of DOS 3.1, provide a full complement of transcendental, and a host of utilities to mimic the UNIX and XENIX™ environments.

Lattice now delivers smaller .EXE files, curing one past complaint, boasts very fast link times and a more efficient aliasing algorithm.

The compiler now defaults to the ANSI proposed standard when you need a strict mistress, but command line options tolerate straying. New options generate

a single command may represent several score lower level statements. It offers all the capabilities of level "2b" of the ANSI Graphical Kernel Systems, (GKS) spec.

Plotting has equivalent tools specializing in graph and chart generation and their captioning. Hand it apples and oranges, "pie", and it bakes the numbers into a digestible display for screen or plotters.

Kernel and Plotting have tools to convert images they create to virtual device metafiles (VDMs), a tokenized standard for storing graphic images as data. The Metafile Interpreter reads the contents of a VDM and interprets it for re-creation on various devices, and you can cut and paste before display.

Quality software? IBM thinks so. They sell the GSS series under their own label.

Now, what about royalties? There are none as such. Buy whichever components you choose. Then, for each which will incorporate into an application, pay a premium - now or later - but only once. Once paid, you are free to create and distribute any number of applications.

Code:	Product:	List:	PC
GSO01	Drivers	\$200*	\$169
GSO0C	C Bindings	\$150	\$129
GSO20	Kernel System 256k	\$495	\$419
GSO30	Plotting System 192k	\$225	\$189
GSO40	Metafile 256k	\$175	\$149
One-Time Redistribution Premium: Drivers \$200, all others \$500.			

Product: List: PC Brand:

code to use 80186 and 80286 instructions, and the 8087 is of course sensed and utilized if aboard.

Lattice has enjoyed pre-eminence so long that developers have created far more tools to marry into Lattice C than any other compiler. Programmers now have an enormous resource of libraries and utilities to use with Lattice to speed their work. William Hunt, in his exhaustive analysis of 12 compilers in the 1/86 issue of the PC Tech Journal awards Lattice the only "very good" rating for add-on library availability; puts Lattice in the top three for documentation quality, calling it "one of the most usable in the group"; and sums up with this all-around accolade - "a fine product to consider for the production of important applications."

Product Code: S0100 PC Brand:
List Price: \$500.00 \$299.00

BETTER BASIC

New Version Compatible with Microsoft BASICS

If you have several thousand hours of BASIC programming under your wing, what a dilemma the great migration to C poses! BetterBASIC™ offers an ideal sanctuary. Its design principle is simple - build the most useful features of C, Pascal, and Modula 2 into BASIC, while retaining the familiarity of a language known to millions. Version 2.0 is 100% compatible with Microsoft GW™-BASIC and IBM BASIC and BASICA. Just load old programs and run. Save, and they are converted to BetterBASIC.

BetterBASIC is big. Its hugely expanded features require 192k; your programs can go all the way to the PC's full 640k. It is comfortable. It behaves like Microsoft BASIC at the interactive level, with a full-screen editor, direct statement execution, and always poised to RUN. But it is fast. BetterBASIC is not an interpreter. It is an incremental compiler. Each line you type is compiled (and error-checked) on the spot just once, re-interpreted over and over at run time. The Sieve benchmark runs 6 times faster than with Microsoft

BetterBASIC has C-like structures. Gather variables of different types into a record and give it a name. Thereafter only the structure name for file reads and writes, leading to the unmourned demise of FIELD, MKS\$, CVD, LSET, etc.

BetterBASIC has "procedures" summoned by name unlike GOSUBs. Best of all, store finished procedures in compiled modules - a single copy to use with any number of future programs.

Lots of features round it out: a built-in linker for compiled modules, a cross-reference command, 32k strings, DOS and BIOS calls, recursion, and an easily used assembly language interface. Ask about these options: 8087 support module, Bribee interface, run-time module for redistribution.

Product: List: PC Brand:
S1200 \$195.00 \$169.00

800 PC-BRAND

That's (800) 722-7263. In NY State call (212) 410-4001.

PC Brand, P.O. Box 474, New York, N.Y. 10028

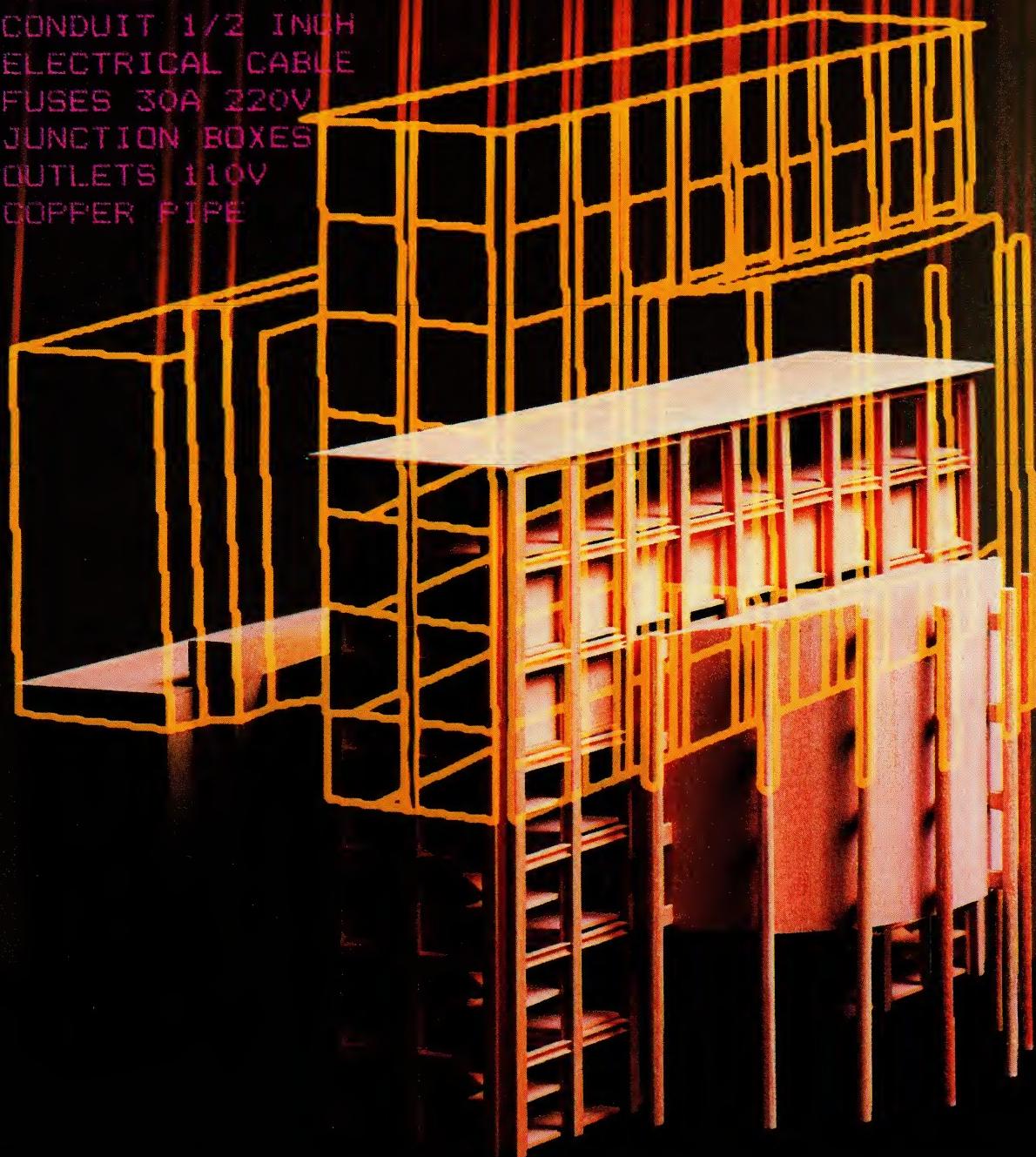
Telex: 667962 (SOFT COMM NYK)

CIRCLE NO. 171 ON READER SERVICE CARD

© 1986 PC BRAND Prices, terms, and specifications subject to change without notice.

SAVE \$5
Just tell us
this code
J3

CONCRETE 50 LB
JOISTS 6INCH x 12INCH
FLOORBOARDS
STUDS 2INCH x 4INCH
WALLBOARD
NAILS VARIOUS
INSULATION R30
VAPOR BARRIER
4INCH FACE BRICK
DOOR B LABEL 1-1/2HR
WINDOWS
CONDUIT 1/2 INCH
ELECTRICAL CABLE
FUSES 30A 220V
JUNCTION BOXES
OUTLETS 110V
COPPER PIPE



A CADD Solution

CADVANCE takes micro-CAD systems one step closer to full CADD status by offering the database extraction features normally found on larger systems.

VICTOR E. WRIGHT

The increasing number of sales of microcomputer-based CAD packages demonstrates the success with which personal computers are able to host real computer-aided drafting systems—perhaps to the dismay of the manufacturers of larger CADD (computer-aided drafting and design) systems. One such manufacturer, CalComp, has come to grips with the micro-CAD phenomenon by buying the rights to a well-known micro-CAD package.

CADPLAN, developed by Personal CAD Systems, Inc., was the drafting component of a printed circuit board design system and was also marketed as a general purpose CAD system to architects, engineers, and other designers. In

mid-1985, Personal CAD Systems sold the division that marketed CADPLAN to CalComp. CalComp's Personal Systems Unit now is marketing CADPLAN, essentially unchanged, but has added another product to the line, called CADVANCE.

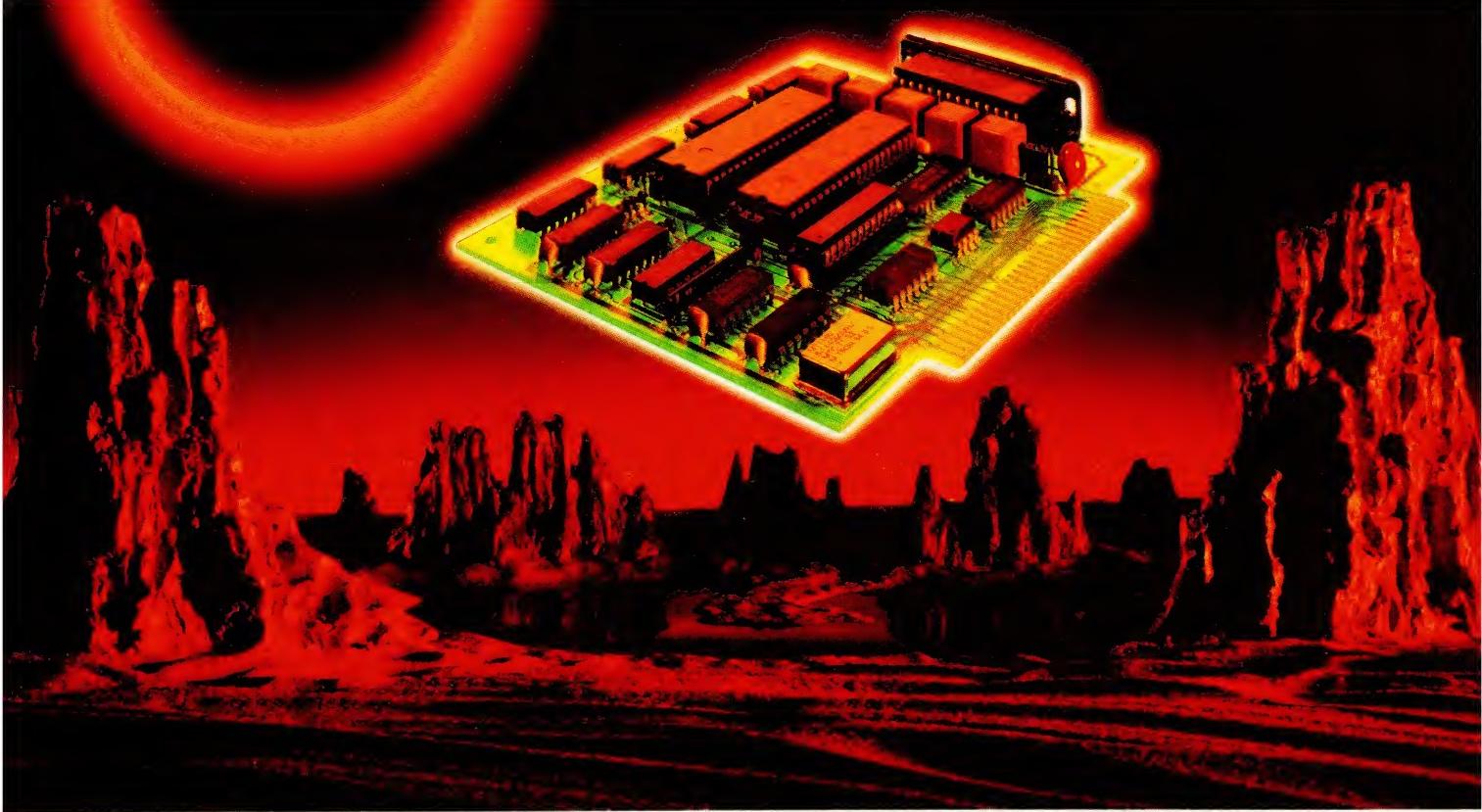
CalComp bills CADVANCE as an entirely new product and encourages registered CADPLAN users to upgrade to the newer, more powerful, and more expensive package. CADPLAN users will immediately notice a strong resemblance between the two products, as well as some significant differences.

CADVANCE can be classified as a production drafting system—that is, it has the features required for the production of working drawings, not just computer

sketches, including automatic dimensioning, hatching, layering, symbols, macros, and database extraction. The program is a two-dimensional system, but can be used in conjunction with MEGA CADD's Design Board Professional (see "Three-Dimensional Modeling," Victor Wright, February 1986, p. 88), via the Design Board Link program.

CADVANCE is designed to run on the PC/XT, PC/AT, or a true compatible. The host computer must have 512KB of RAM, a serial port, a parallel port, a graphics card, a suitable monitor, and a hard disk. The program is too large to run on two 360KB floppy-disk drives.

Like its predecessor CADPLAN, CADVANCE is intended to be a menu-driven



NEW!
\$975.00

DATAHAWK

MAKE YOUR IBM PC® A DATA LINE MONITOR.

Now you can pinpoint send/receive problems with a personal computer! DATAHAWK™ turns your IBM PC and compatibles into a *fully functional* data line monitor.

DATAHAWK works on equipment you already have. When not doing data line monitoring, your PC performs all of its usual tasks, so one personal computer serves two functions. And it's far less expensive than any conventional DLM.

It's simple to use. DATAHAWK takes no special training, operation, startup, and keyboard are already familiar to PC users.

- Functions on IBM PC's and compatibles (such as Compaq®)
- User-selectable monitoring, simulating and testing options
- Performs FOX, BERT, BLERT and other tests
- Protocols supported: Asynchronous, Byte Synchronous, SDLC/HDLC
- Higher-level protocol analysis options for SNA/SDLC, and X.25
- 48" test cable that inserts in RS-232C line
- User's Guide with installation and operating instructions
- Compact board that fits in your PC's short slot

Order DATAHAWK today and start saving money, space and time!

Call Renex at **1-800-345-4334**

A BETTER WAY



Renex
Corporation

Eastern Region
(703) 494-2200

1513 Davis Ford Road • Woodbridge, VA 22192
Representatives and Sales Agents Worldwide

Western Region
(415) 465-9399

CIRCLE NO. 173 ON READER SERVICE CARD

Order DATAHAWK today!
Multiple quantity discounts!

1-800-345-4334

VISA, MasterCard accepted!
Only \$975.00 each!

IBM PC is a registered trademark of International Business Machines Corporation. Compaq is a registered trademark of COMPAQ Computer Corp. DATAHAWK is a trademark of Renex Corporation.

CADVANCE

program, with selections entered via a pointing device or from the keyboard. A serial input device must be attached to the serial port while creating and editing drawings; both mice and digitizer pads are supported. All the plotters listed as being supported are serial plotters, requiring an additional serial port or a means to share the port between the input device and the plotter—swapping cables is workable. A buffer can be connected between the computer and the plotter; the manual lists only serial buffers.

A parallel printer can be attached to the parallel port. If the system does not have a parallel printer, the port is still required for connection of the copy-protection device, a small black box with a 25-pin connector on each end. The box can be connected between the printer and the computer or by itself. It is inconvenient if several packages with different hardware copy-protection devices are being used.

The 8087 math coprocessor IC is used, if present, for some floating-point arithmetic functions, such as the regeneration of circles.

CADVANCE uses a 16-bit integer database; this is apparent because the drawing world is 60,000 units in both the *X* and *Y* directions. The newest release of CADVANCE is expected to increase the world size to 64,000 units. An integer database provides uniform resolution over the entire drawing world, but the size of the drawing world varies with the assignment of real world units to the system's smallest unit. In contrast, a floating-point database provides a much larger drawing world, but the resolution is finer near the origin, less so toward the outer limits.

Some large systems use 32-bit integer database structures, which provide approximately 4 billion addressable points in each direction. CalComp's selection of the 16-bit format will not present a limitation to most users—with the smallest unit set to represent one-eighth inch, the system can accommodate a building that is 625 feet square, adequate for most uses of a micro-based CAD system. A machinist wishing to draw a part to an accuracy of .0001 inch, however, might not appreciate being limited to a 6-inch square. (Of course, neither the graphics display nor the plotter can produce displays with an accuracy of .0001 inch—but, if automatic dimensioning is to work, the database must include the accuracy desired in the dimensions.)

CalComp selected the 16-bit integer database for purposes of speed and

resolution. The resolution that can be achieved with the 16-bit as opposed to the 32-bit integer database is sufficient for CADVANCE's supported output devices. Future versions of the package may well be based on a 32-bit integer database or a floating-point system, according to CalComp.

CADVANCE stores an entire drawing in RAM and saves to disk only on command. Thus, drawing size is limited not only in the sense that the drawing world has finite limits but also in the number of objects that can be stored in the database. The advantage of such an arrangement, of course, is that drawing sessions are not interrupted by time-consuming disk accesses.

One key to the success of microcomputer-based CAD programs is the ability to run the program on various hardware configurations, ranging from a garden variety microcomputer that can

Like its predecessor CAD-PLAN, CADVANCE is intended to be a menu-driven program, with selections entered via a pointing device or from the keyboard.

be used effectively as a word processor and spreadsheet machine to a high-performance machine optimized for high-quality graphics. If the machine is used only occasionally for CAD, low-resolution graphics may suffice, whereas high-resolution graphics may be a requirement for a machine that is dedicated to CAD work, particularly if it is used in marketing presentations.

CADVANCE properly addresses this issue by the use of modular device drivers, all of which are included in the standard package. The manual mentions only the standard IBM Color Graphics Adapter (CGA), the IBM Professional Graphics Controller (PGC), and the Conographics Cono-Color 40 as supported graphics boards. The distribution disks, however, also include drivers for the Conographics card in a second configuration (60 Hz refresh instead of 73 Hz), the Hercules Monochrome Graphics Card, a second configuration for the CGA, the IBM Enhanced Graphics Adapter with 64KB video RAM or 256KB RAM, the Sigma 400 Graphics

Card, the Artist I board, the Wyse 700 board, and the Verticom M16 Graphics Card. Available resolution ranges from 320-by-200 pixels in four colors with the standard IBM color card to 640-by-480 pixels in 16 colors, selected from a possible 4,096 colors with the PGC. The prices of the supported graphics cards range from about \$900 for the standard set-up to \$4,300 for the PGC. If resolution is the key criterion, the Hercules Graphics Card and a suitable monitor—the 14-inch Roland DG MB-142 white-on-black/black-on-white is impressive—is probably the best buy, providing resolution of 720 by 348.

The IBM Enhanced Graphics Adapter (EGA), with 64KB of RAM installed in its basic configuration, provides four colors at 720-by-350 pixels, comparable to the resolution of the Hercules board, but at a higher cost.

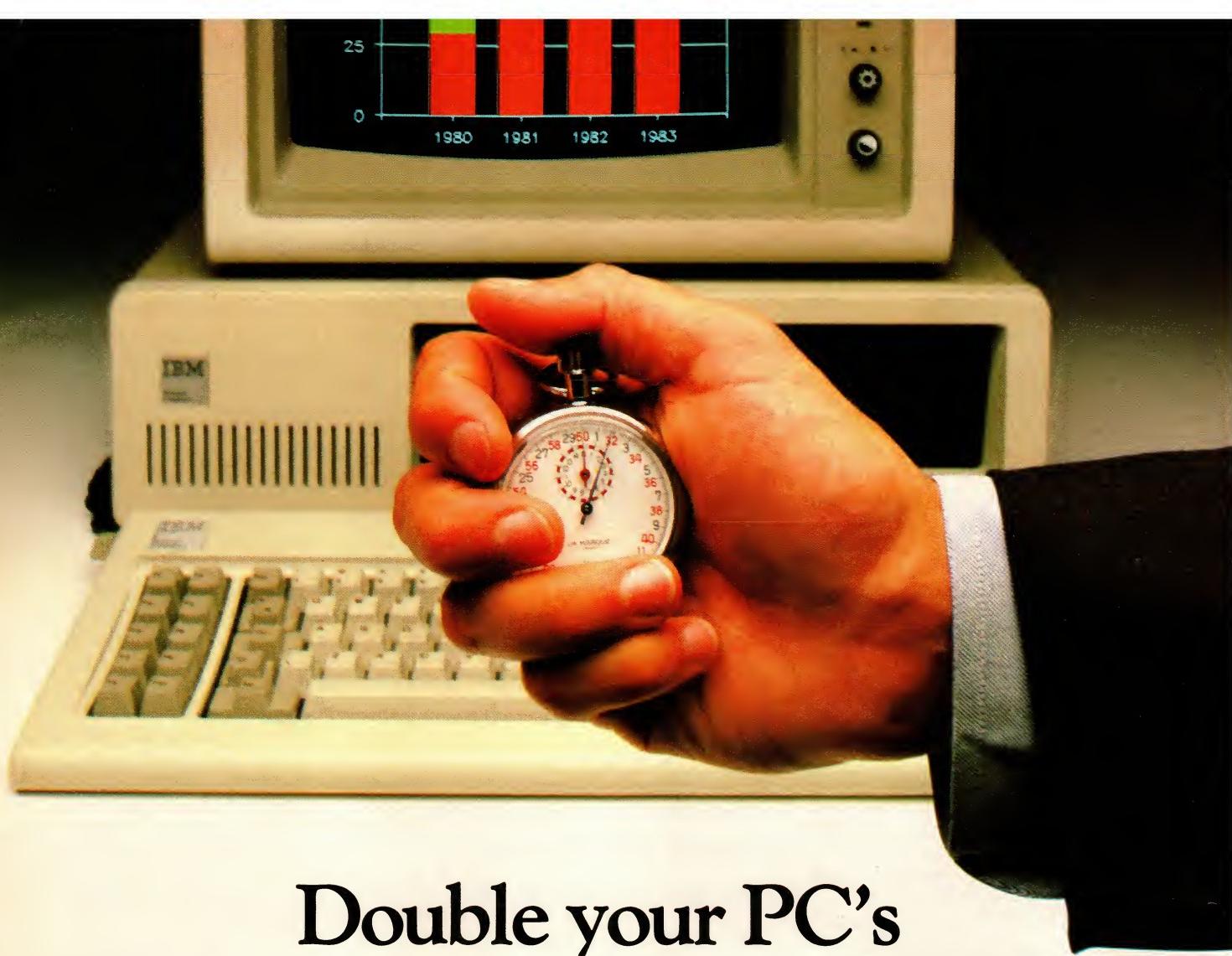
The Conographic card provides the best compromise between all-out performance and cost. The Cono-Color 40 card is less than one-third the price of the PGC and, as supported by CADVANCE, displays as many colors simultaneously, out of an admittedly smaller possible 256 colors, with only a small sacrifice in resolution—640 by 400 for the Cono-Color 40 versus 640 by 480 for the PGC.

Both the Conographic card and the PGC are analog RGB cards, as opposed to digital RGB cards, such as the CGA and EGA. As supported by CADVANCE, both require the use of an analog, long-persistence RGB monitor (the Cono-Color 40 will drive a digital monitor, but not as supported by CADVANCE). The manual recommends either the Electrohome D03101-60 or the Hitachi HM-2719B-C-11 monitor with the Conographic card, and the IBM Professional Color Display with the PGC.

The standard display—four colors at 320 by 200—may look impressive to a first-time CAD user, and the economics of a high-resolution graphics card may not seem justifiable. However, resolution of 720 by 348 for monochrome or 640 by 400 for color should be the minimal configuration.

RESPONSIVE PERFORMANCE

For this review, CADVANCE was tested on several different hardware configurations, including an XT with the Hercules Graphics Adapter; the same computer using the Hercules Color Card; a Heathkit H-161, PC-compatible, portable computer; a Heathkit H-200, AT-compatible computer with a 256KB EGA emulating the standard color card; and the EGA without its piggyback memory card (a 64KB system).



Double your PC's processing speed for under \$600.

The speed of an IBM® AT, with QuadSprint by Quadram®.

Quadram introduces a rapid advancement in IBM PC performance. QuadSprint. The innovative expansion board that doubles the processing speed of your personal computer. Just plug the totally transparent QuadSprint into your system and watch all your PC programs (Lotus 1-2-3™, dBASE III™, Wordstar™, and more*) run faster and more efficiently than ever before...without special commands or interface software.

But best of all, you can pick up QuadSprint without running up a huge bill. At less than \$600, QuadSprint is about half the price of other accelerator (turbo) cards and turns your PC into a machine that's virtually as fast as the new PC AT.

So make your own rapid advancement. To the Quadram dealer closest to you. And see how

to double the processing speed of your IBM PC®. With QuadSprint by Quadram. For more information, call or write us at Quadram Corporation, One Quad Way, Norcross, GA 30093-2919 (404) 923-6666.

QuadSprint™



QUADRAM®

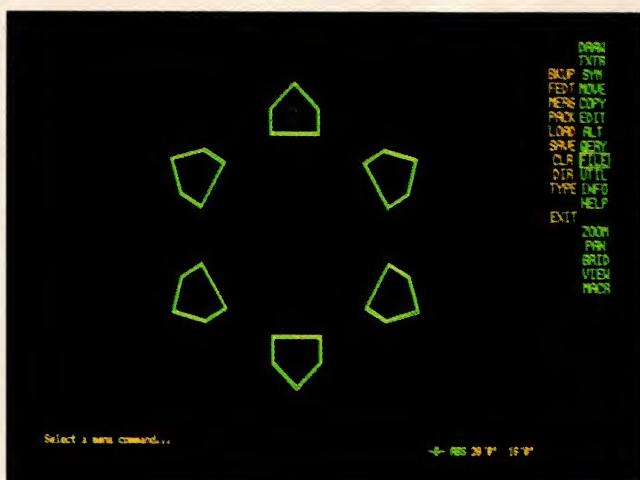


CIRCLE NO. 147 ON READER SERVICE CARD

IBM PC, PC AT are registered trademarks of International Business Machines Corporation. *Lotus 1-2-3 is a trademark of Lotus Development Corp. dBASE III is a trademark of Ashton-Tate Inc. Wordstar is a trademark of MicroPro Corp. QuadSprint is a trademark of Quadram Corporation. Quadram and the Quadram logo are registered trademarks of Quadram Corporation. Copyright 1985 Quadram Corporation. All rights reserved.

CADVANCE

PHOTO 1: Screen Display



The COPY/CIRC command copies and positions the object in a circular array. The object can be rotated or not as desired. The display shown is an EGA but the area occupied by the menu is the same as for other hardware configurations.

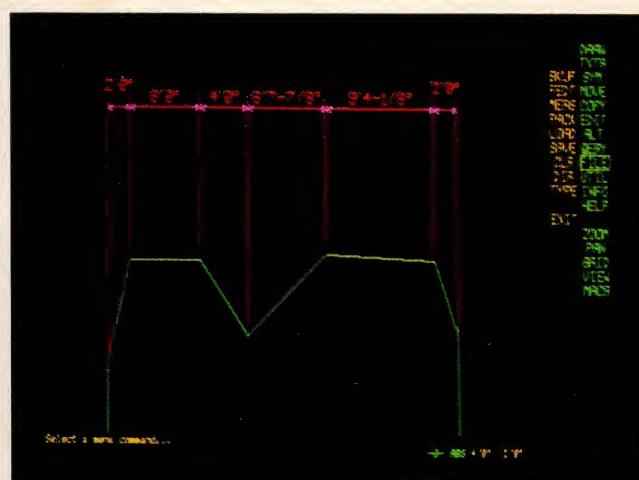
CADVANCE is a more responsive program than its predecessor CADPLAN, based on each product's performance on the XT with the Hercules Color Card installed. The difference in response is most noticeable when dragging shapes to new locations with the MOVE command. In fact, dragging should be avoided with CADPLAN whenever possible, instead entering only the endpoints of the displacement vector.

The 286-based, H-200, AT-compatible with an EGA installed provides a considerable increase in responsiveness over the XT with the Color Card installed. (High resolution is obtained with more video memory, and more memory takes longer to update.) On the XT the user is able to move the mouse faster than the computer can update the screen, but the AT-compatible machine keeps pace easily.

CADVANCE's display with the Hercules Graphics Card was fine. In one session, however, with both the Hercules Color and Graphic cards installed in the same computer, switching from graphics to text and back to graphics made a total disaster of the display. CalComp suggested changing the number of files in CONFIG.SYS from the 15 that the manual suggests to 30. This apparently cured the problem. Of course, the Hercules cards must be initialized with the HGC FULL command issued from DOS before loading CADVANCE.

The CADVANCE screen display is divided into three general areas (see photo 1). The largest and most prominent area is the graphics viewport, where a view of the current drawing is

PHOTO 2: Dimensioning Facility



The dimension markers (arrows or slashes, for example) are stored as symbols. The dimension values are calculated by CADVANCE. If a vertex is moved after the dimensioning is completed, the incorrect value is not changed.

displayed. On a standard 13-inch color monitor, this area measures about 6½ inches wide by 5½ inches high. The resolution of the viewport is a function of the graphics display hardware.

The right side of the screen is the menu area. It accommodates two columns of menu selections, each four characters long. The characters are generated graphically, not by the computer's character generator. The right-most column is the main menu, which is always displayed and available for command entry. The left menu column displays submenus of options to the main menu commands. When the program is loaded, the submenu column is blank. As commands are entered from the main menu, the submenus appear.

The third area of the CADVANCE screen consists of a prompt line and a status line at the bottom of the screen. The status line, which is the lower of the two lines, displays the coordinates of the cursor, the type of coordinate display (absolute, relative, polar-relative, or polar-absolute), and the snap mode (off, nearest grid point, nearest node, nearest vertex, nearest intersection, and nearest point on a line). Above the status line is the prompt line, which is used to display messages and option menus for certain commands.

Command entry is accomplished by selecting commands from the screen menu—either typing them at the keyboard or using a digitizer menu if a digitizer is used as the pointing device. Commands are entered from the keyboard as keystroke sequences. The sequence must begin with the slash (/)

character and consist of the first letter of a command from the main menu, followed by the first letter of an option or subcommand from the submenu. VisiCalc and TK!Solver users should appreciate this feature.

A pointing device can be used to move the cursor anywhere on the screen, and the cursor changes shape depending on its position and command status. In the graphics viewport the cursor is a small cross, but can be changed to a large cross or an isometric cursor. The cursor is a box in the menu area or the status/prompt line area. During the execution of some commands the cursor changes to an X.

Normally, a command is entered, then options selected, and data entered. However, certain commands can be nested. For example, the viewport of the display can be changed within a drawing command so that large objects will not sacrifice accuracy.

DRAWING PRIMITIVES

The first command in the CADVANCE main menu is DRAW, which provides 12 options for creating *drawing primitives*. The collection of drawing primitives, which is larger than that included with many other CAD programs, includes lines, parallel lines (walls), rectangles, circles, arcs, curves, text, nodes, ellipses, polygons, fillets, and dimensions. The options are actually mode specifications—when the LINE option is highlighted, CADVANCE expects only endpoints of line segments. Line segments entered in a continuous sequence are treated as a single object, and multiple

CADVANCE

sequences can be entered without repeating the DRAW/LINE command. Each drawing primitive option displays a prompt, requesting appropriate parameters. The CIRC, ARC, and ELIP options provide several ways to specify the actual configuration of the primitive.

CADVANCE makes extensive and effective use of rubberband cursors. Accepted objects are shown in one color; rubberband displays of new objects are shown in another. Line segments are accepted as they are entered. Some objects—ellipses, for example—require two button presses for acceptance.

The provision of an option to create parallel lines (2LIN) is a feature architectural designers will especially value for drawing walls. This command mitered corners correctly, including the last one if a closed figure is entered by placing the last vertex at the first one.

Line type and weight can be specified from the status line when the LINE mode is active. Line type and weight are attributes of the drawing object, not of the layer containing the object.

A rectangle can be created with the single RECT command and the input of two points—two ends of a diagonal. A rectangle is drawn with single lines; therefore, walls are more effectively created with the 2LIN option.

The CURV option of the DRAW command bears special mention, because it provides for three types of curves—cubic, B-spline, and Bezier. A curve is specified by as many as ten points. Cubic curves pass through all points, fitted so that the second order derivative is continuous. The B-spline and Bezier curves pass through the endpoints; the intermediate points serve as controls to shape the curve using the Cox and de Boor and the Geometric Bezier algorithms, respectively.

The TXTR main menu command is the equivalent of the hatching command in other packages. However, TXTR offers some features not found in many hatching commands. It will not only cross-hatch enclosed areas, but also will create textured lines consisting of line segments and/or symbols. Any currently defined symbol can be used to define a textured line. The ADD and DEL options in the TXTR command allow definition and deletion of textured line definitions on the fly.

CADVANCE includes dimensioning in the DRAW command. The dimensioning feature is straightforward, but provides only the basic functions. The user can control dimension line weights, locations, markers—arrowheads, slashes, etc.—and text style. The LINE and RAD

dimension commands control linear and radial dimensions, respectively. The dimension command AUTO may surprise users of other CAD programs, because it automatically creates linear dimensions between all vertices found in a search box. To define the search box, the program requests a dimension line, which must extend past the two outermost vertices, and a dimensioning depth. The program automatically creates extension lines, one extending from each vertex in the search box to a predetermined distance past the dimension line. The dimension line is trimmed at the two outer extension lines, and dimension markers and text are added (see photo 2).

EDITING METHODS

The MOVE, COPY, and EDIT commands give CADVANCE complete editing abilities. MOVE displays four methods of specifying which objects to move on the prompt line; these methods are used in other commands that require selecting objects. The first method is PNT, which allows the selection of an object by selecting a point on it. IDEN is similar to PNT except that multiple objects can be selected. The third method is WIN, which selects all objects completely contained in a window specified by two

WINDOWS FOR C™

Advanced screen management made easy



WINDOWS FOR C™
was ranked #1 by
PC TECH JOURNAL

(Review by William Hunt, July 1985)

In comparison with five
Windowing Utilities for C
[Window Machine, (Lattice Windows),
CRIOS, Building Blocks II and C-LIB]

WINDOWS FOR C came out as the winner.

Overall Quality	# 1
Display Speed	# 1
Ease of Use	# 1
Code Size	# 1
Documentation	# 1

For all popular C-compilers operating under PCDOS. Plus versions for XENIX & UNIX.

Trademarks — Lattice Inc.; UNIX, AT&T; XENIX, Microsoft

opposite corners. Finally, MULT is used to specify several windows.

After the objects to be moved are selected, CADVANCE requests a displacement vector. As soon as the vector's first point is specified, the selected objects disappear and are replaced by a few key points that shift as the cursor is moved. Thus, the objects can be dragged into position. Response is fast, because entire objects are not redrawn each time the shape is moved. As the shapes are moving, they are drawn as dotted lines. When movement stops they are redrawn as solid lines.

The COPY command displays a submenu of four options—ARRY, SNGL, CIRC, and MIRR. ARRY creates multiple copies of selected objects arranged in rows and columns, and SNGL makes a single copy. CIRC creates a circular array, with multiple copies of the specified objects arranged in a circle, the center and radius of which are user-specified. The objects can be rotated as they are copied (see photo 1). MIRR creates a mirror image of one or more objects, mirrored in respect to a line that can be drawn at any orientation, not just horizontally or vertically as is the case with some CAD programs.

EDIT provides 12 selections in a submenu. Objects can be DELETED,

ROTATED, and SCALED. Object selection is by the four options used in MOVE and COPY. EDIT also allows editing vertices—endpoints of line segments and key points of other objects. ADDV, MOOV, and DELV add a new vertex, move a vertex, and delete a vertex, respectively. The effect of these commands varies with the shape being edited: DELV can turn a rectangle into a right triangle; ADDV can transform a triangle to a diamond; and MOOV can move a circle without distortion.

A line, circle, or arc can be broken into two sections, separated by a gap, with the BRK command. Curves cannot be broken arbitrarily, but the arcs connecting the vertices can be broken. The TRIM option allows the selection of objects, the specification of a trim line that intersects the objects, and a trim side. The portions of the selected object(s) that appear on the trim side of the trim line are erased, whether or not the trim line actually extends through the entire object. This feature is similar to the clipping windows of larger systems.

The FIX option is used in conjunction with the DRAW/2LIN command to create neat wall intersections. Although DRAW/2LIN creates properly mitered corners, the additions of intersecting walls are not handled automatically. FIX

cleans up cross, Y-, and T-shaped intersections, in accordance with standard architectural drafting practice. Some competitive packages require the user to execute several commands in order to accomplish the same task.

UNDO takes advantage of the fact that the DEL command does not actually remove objects from the database, but simply marks them deleted and removes them from the screen display. UNDO brings back any deleted objects within a window, first highlighting them and requesting confirmation from the user of the UNDO command.

A single or wall line can be broken and a specified symbol inserted in the break with CADVANCE's OPEN command. This powerful command accomplishes a sequence of operations that would require several commands in many other micro-CAD packages, and it greatly simplifies the task of inserting windows and doors in walls. OPEN's complement is CLOS, which removes symbols that were inserted with the OPEN command and reconnects the lines. This operation also would be more time consuming with most other CAD systems.

CADVANCE provides the usual complement of display control commands, of which ZOOM and PAN are the most frequently used. ZOOM

WINDOWS FOR DATA™

Featuring One-Step Data Entry •

Now you can code fast, powerful data entry windows, improve user convenience - reduce input errors.

All the power, convenience and flexibility of the #1 window utility for the IBM PC. Our WINDOWS FOR C™ combined with a professional window-based data entry system.

Complete control over screen display and entry of data within a convenient flexible window environment.

WINDOWS FOR C WINDOWS FOR DATA
(Includes WINDOWS FOR C)

PCDOS	\$ 195	\$ 295
PC/XENIX	\$ 395	\$ 595
UNIX	CALL	CALL

Full source available. Master Card & Visa accepted. Shipping \$3.50. VT residents add 4% tax.

WINDOWS FOR DATA™ provides versatile, easy-to-use data entry functions that operate within windows.

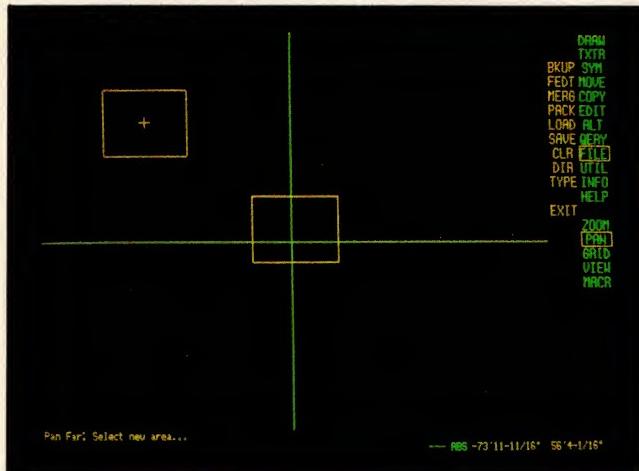
CAPABILITIES INCLUDE:

- Pop-up data entry windows
- Multiple field types
- Data validation functions
- Field-specific & context-sensitive help
- Lotus-style menu design
- Single field entry option
- Date, time and string utilities
- Dynamic control of data-entry environment
- ◆ User input to data-structure variables without intervening code.



**Vermont
Creative
Software**

21 Elm Ave.
Richford, VT 05476
802-848-7738, ext. 21

PHOTO 3: Windowing Facility

The present viewport is positioned centrally in the long range view. It can be changed without affecting the scale by moving the other window to the desired position.

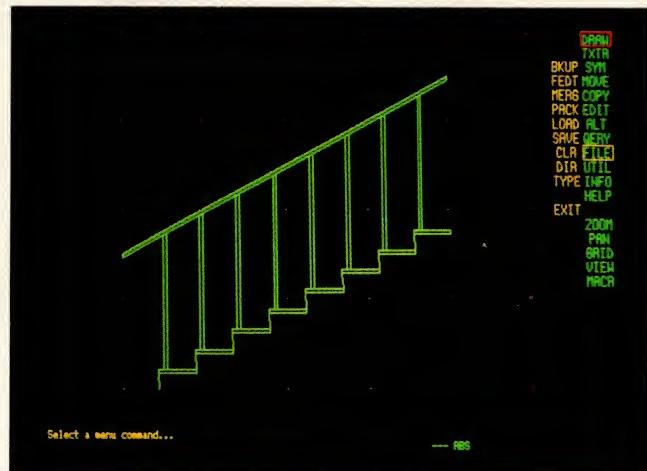
changes the scale of the display, showing a larger or smaller portion of the drawing in the viewport.

The ZOOM command actually provides four options—IN, OUT, WIN, and BY—which are displayed on the prompt line when the ZOOM command is entered from the main menu. The IN and OUT options request a view center, which is indicated by positioning the cursor in the viewport with the pointing device and clicking the button. A drawing can be displayed in ten different scales using the ZOOM command; these scales are fixed.

The WIN option requests the entry of two corners of a ZOOM window and can be used only to ZOOM in. The minimum display scale is fixed; entering ZOOM WIN while at the minimum scale simply repositions the center of the window at the center of the viewport.

The BY option allows specification of an arbitrary ZOOM factor, in the range of .010 to 8.00. Changing the ZOOM factor changes the number of ZOOM steps available. Again, the maximum and minimum scales are fixed.

A drawing can be moved in the viewport without changing the scale using PAN. This command displays six options. LEFT, UP, DOWN, and RIGHT move the drawing under the viewport by a fixed step. SHORT requests a new view center. FAR displays the entire drawing world on the screen, with the current view outlined in the center, and a movable window at the same scale (see photo 3). By positioning the movable window with the pointing device, the viewport can be moved across the drawing world quickly.

PHOTO 4: Stair Macro

The macro feature can partially or completely automate some of the design tasks. The stairs were drawn using the predefined macro by specifying eight variables.

The VIEW command allows definition and recall of ten numbered views and provides options to highlight key drawing features, such as shape vertices, symbols, and text.

The display control commands can be nested inside the DRAW commands. CADVANCE's command to plot a drawing is buried in the main menu UTIL command. The manual devotes 20 pages to the PLOT subcommand and its options, not including the appendices that describe the configuration of the supported plotters. This extended coverage reflects the program's degree of control over the plotting process.

Most novice CAD users have difficulty with the concept that CAD drawings are created in real-world units and plotted to scale. In the manual drafting process, the scale at which a drawing is to be created must be determined in the very first step. Another troublesome concept for beginners is that certain drawing features, such as notes, dimension markers, etc., must be sized in real-world units so that they plot out at the correct size. Both concepts are the reverse of manual drafting.

CADVANCE complicates the plotting process by using two scale factors: drawing and plot. Drawing scale describes the relationship between CADVANCE's drawing units and real-world units—the largest ratio allowed is 1 to 1. Plot scale provides for a magnification or reduction factor. The scale of the final plot is determined by the product of the drawing and plot scales. The process is further complicated when CADVANCE is used to drive a CalComp 1043 plotter, which has yet

another scale factor to be set at the plotter's control panel.

CADVANCE supports a variety of plotters: AlphaMerics, CalComp, Hewlett-Packard, Houston Instrument, IBM, Nicolet, Ioline, and Enter Computer (Sweet-P). The manual provides set-up information on all supported plotters, including switch settings, cable wiring, and device driver names.

Setting up the plotter involves several steps. First, the plotter is physically connected and configured. Then the INSTALL.BAT file is used to copy the correct plotter driver file to the PD.DRV file. The plotter parameters must be set using the INFO command. Any further changes are made from the UTIL/PLOT command when the plot is made.

Plotter output can be sent directly to the plotter, to the plotter through a buffer, or to a disk file. Plotter output saved as disk files can be plotted on different shifts, different computers, or through a network.

FILE MANAGEMENT

CADVANCE has several different file types. The two most frequently used types are drawing files, which have an extension of .VWF, and symbol files, which have a default extension of .SYM. In addition, the program uses macro files, called filename.MAC by default; plot-output files (.PLT); graphic data interface files for transfer of graphic data to larger systems (.IGS); configuration information files (.CFG); font files (.FNT); and attribute data files containing symbol and layer information (.ADF). If the DBE facility (described below) is used, then .DBF, .NDX, and .BAT files are available.

*Special
Money
Saving Offer!*



NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

A series of ten horizontal black bars of varying lengths, intended for a postage indicia stamp.

BUSINESS REPLY MAIL

FIRST CLASS PERMIT NO. 66 BOULDER, COLORADO

POSTAGE WILL BE PAID BY ADDRESSEE

TECH
PC
JOURNAL

P.O. BOX 2966
BOULDER CO 80321

THE MAGAZINE FOR IBM EXPERTS AT 50% OFF!

SEND ME:

12 ISSUES FOR \$23.70

24 ISSUES FOR \$47.40

I GET TWO ISSUES FOR THE PRICE OF ONE!*

MR. / MRS. / MS.

PLEASE PRINT

PT 5S241

COMPANY.

BUSINESS
 HOME

ADDRESS

CITY

STATE

.ZIP

CHECK ONE: PAYMENT ENCLOSED BILL ME LATER

ADD \$6 PER YEAR IN CANADA AND ALL OTHER FOREIGN COUNTRIES.
PLEASE ALLOW 30 TO 60 DAYS FOR DELIVERY OF FIRST ISSUE.

*SAVINGS BASED ON SINGLE COPY PRICE OF \$3.95.

FORTRAN FROM THE HIGHEST AUTHORITY.



G. P. Morris 85

Using the right FORTRAN compiler can do wonders for your creativity. So why not go right to the top? Namely, Ryan-McFarland's RM/FORTRAN™.

RM/FORTRAN is nothing less than a mainframe FORTRAN compiler made for a pc. It's a full ANSI FORTRAN-77. And the only pc FORTRAN GSA-certified error-free at the highest level. So unlike other pc FORTRANS, it's not just based on the standard. It is the standard.

It's also full of extensions, like VAX, VS and FORTRAN-66. So you can port your mainframe or mini FORTRAN applications back and forth to your pc without losing anything in the translation.

Our speed is superior, too. Independent benchmarks show we outrun every other pc FORTRAN on the market.

By as much as 40% or more!

The reason is our high optimizing compiler. First, it reduces the number of

instructions actually executed to the bare minimum. Then it adjusts the resultant code to each processor to coax every bit of speed from the hardware. The result is object code so fast and compact you may never need to go to the mainframe again.

Speaking of which, there's also support for arrays larger than 64K. And a mainframe-style interactive debugger to help you watch your language in development.

RM/FORTRAN is available for machines based on the 8086/8088/80286 processor family, as well as all 68000-based machines. A version of RM/FORTRAN is also available under the catchy name, *IBM PC Professional FORTRAN* by Ryan McFarland, at your neighborhood IBM® Product Center.

Or get in touch with us directly at (213) 541-4828, or 609 Deep Valley Drive, Rolling Hills Estates, CA 90274.

And then you can rest.

R III RYAN-
MC FARLAND
Masters of the Language.



Ed's fortunes changed when he chose a wimpy database that couldn't network.

Had Ed chosen Network Revelation® his data, and career, would have been secure. Because Network Revelation is a complete database applications environment that safeguards data by locking at the record level. So two users can't accidentally change the same record at the same time.

There's more. Network Revelation includes an applications generator that automatically writes code in R/BASIC, Rev's powerful programming language. And for the rest of us, there's a versatile report writer with English language queries.

All this is built around a systems approach to database management that has the muscle for even the toughest multi-user applications.

The secret is superior technology.

Variable-length fields save disk space on network servers. Unlimited files, fields and records keep pace with your expanding information needs. Data dictionaries make it easy to change your database when you change your mind. And our high-speed compiler accelerates program execution.

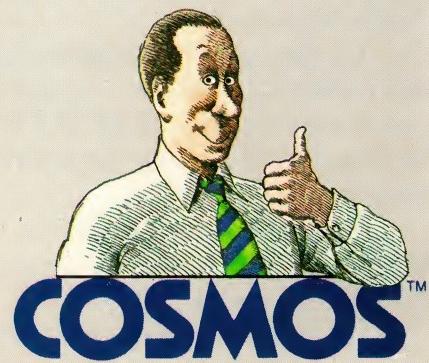
To make upgrading your present single-user application even easier, dBase II® and Lotus 1-2-3™ conversion utilities are included.

Network Revelation prices start at a mere \$1495. Implementations for IBM's® PC Network, 3Com's™ EtherSeries,™ Nestar and Novell NetWare™ are all available now.

Call today to order our \$24.95 Demo/Tutorial (includes free demo

disk) or to schedule a career-altering demonstration of Network Revelation's superior capabilities.

IBM® of International Business Machines. NetWare™ of Novell, Inc. 3Com™ and EtherSeries™ of 3Com Corporation. 1-2-3™ of Lotus Development Corporation. dBase II® of Ashton-Tate.



Cosmos, Inc., 19530 Pacific Highway S., M/S 102, Seattle, WA 98188, (206) 824-9942, Telex: 9103808627

CIRCLE NO. 112 ON READER SERVICE CARD

CADVANCE

Most file management tasks are accomplished with the FILE command in the main menu. This command provides several options: BKUP to make a batch file to write all the files needed for a drawing to disk using DOS's BACKUP command; FEDT, used to edit text files; MERG to load multiple drawing files; PACK to remove deleted items from the database; LOAD to load a single drawing file, overwriting the contents of the database; SAVE to write the drawing database out to disk; CLR to clear the database; DIR to display a disk directory; TYPE to display the contents of a text file on the screen; and EXIT to leave the program.

FEDT is a simple screen editor that could be useful except that invoking it clears the drawing database. The current drawing must be saved before beginning the editing session, then reloaded after editing is complete. The process is almost as inconvenient as leaving the drafting program in order to use an external text editor.

CADVANCE's FILE/LOAD command loads only drawing files, not font files. Changing fonts requires renaming the desired font file to CAD.FNT before starting CADVANCE. This is unfortunate, because the distribution disks include 11 font files. The latest version of

CADVANCE (1.1) is expected to include multiple font capability. According to the manufacturer, as many as five fonts can be used on one drawing.

An essential feature of any CAD program that is used as the basis of a production drafting system is layering. Layers are used to organize the drawing, simplify plotting and screen display, and coordinate the work of various disciplines. The equivalent of CAD layers in manual drafting is the pinbar overlay drafting system. CADVANCE provides a total of 127 numbered layers per drawing. Each layer can be assigned a name and a color, turned off or on, and defined as selectable or not selectable—that is, layers can be left visible for use as reference layers, but protected against editing.

Layers can be assigned nongraphic attributes for use in CADVANCE's database extraction facility (described below). Therefore, the layering facility becomes a tool not only for organizing the graphic aspects of a drawing, but also for structuring nongraphic data that are associated with the drawing.

Layers are managed with the VIEW/LAYERS command, which displays a list of layers, along with assigned names, colors, visibility and selectability status, and identification of the active

layer—the one in which objects are currently being entered.

The CADVANCE manual does not mention a limit to the number of objects that a layer can contain, although the overall size of a drawing has a limit. CalComp claims that this limit is greater than 100,000 objects. (In CADPLAN, layers can be filled up, at which point, another layer has to be selected to serve as the active layer.)

The ALT command in the main menu allows objects to be moved from one layer to another. In addition, ALT allows the user to change line weights and types and text styles.

SYMBOL LIBRARIES

CADVANCE allows for symbols to be created and used, a key feature for any CAD system. The program goes one step further than many CAD packages, however, and includes the facilities for symbol library management.

The CADVANCE system always stores symbol definitions on disk. They are not included in the drawing database. Instead, the drawing contains only symbol references, including the path to the symbol file. When a drawing is recalled for editing, each symbol referenced in the drawing is also loaded. Thus, if a symbol is altered, its new def-

Another in a series of productivity notes on MS-DOS™ software from UniPress.

Subject: Multi-window full screen editor.

Multiple windows allow several files (or portions of the same file) to be edited simultaneously. Programmable through macros and the built-in compiled MLISP™ extension language.

Features:

- Famed Gosling version.
- Extensible through macros and the built-in compiled MLISP extension language.
- Dozens of source code MLISP functions; including C, Pascal, LISP and MLISP syntax checking.
- EDT and simple WordStar™ emulation modes.
- MS-DOS commands can be executed with output placed in an EMACS window.
- Run a compile on your program and EMACS will point to any errors for ease of debugging.
- EMACS runs on the IBM-PC™ (XT/AT), TI-PC™, DEC Rainbow 100+, HP-150™ or any other MS-DOS machine. Requires at least 384K.

Price:

EMACS binary	\$325
EMACS source	995
One month trial	75
Also available for UNIX™ and VMS™	

Call for pricing.

For our **Free Catalogue** and more information on these and other software products, call or write:
UniPress Software, Inc.,
2025 Lincoln Hwy., Edison, NJ 08817.
Telephone: (201) 985-8000.
Order Desk: (800) 222-0550
(Outside NJ). Telex 709418.
European Distributor: Modulator SA,
Switzerland Telephone: 41 31 59 22 22,
Telex: 911859

OEM terms available.
Mastercard/Visa accepted.

TEXT EDITING

**UNIPRESS
EMACS™**

Trademarks of UniPress EMACS and MLISP UniPress Software, Inc., WordStar, MicroPro Int'l Corp., MS-DOS and IBM-PC, IBM, TI-PC, Texas Instruments, DEC Rainbow 100+, and UNIX, AT&T Bell Laboratories, VMS, Digital Equipment Corp, HP-150, Hewlett-Packard Co.

UniPress Software

CADVANCE

inition is used the next time a drawing referencing it is loaded.

Symbols can be created at any time using the SYM/MAKE command. This command asks for the objects that will compose the symbol and then for the basepoint, or the point that will be used to locate future references to the symbol. Finally, the program requests the path to the symbol file and the symbol file name. The path is displayed as a number from 1 to 8, but is defined as a normal DOS path name using the INFO command. Therefore, new symbols can

be stored in predefined directories by selecting the path number.

When a symbol is first defined, it becomes the default symbol name for the SYM/PLAC command, which inserts symbol references in the drawing. As with the DRAW commands, the symbol command options are more like modes than commands. When SYM/PLAC is invoked, the last symbol inserted becomes the default symbol, and new references can be inserted quickly by using the pointing device. All the symbols referenced in the drawing can be listed

with SYM/LIST, which switches the drawing to a text display. The default symbol is highlighted in the list of symbols and can be changed by moving the highlight with the pointing device.

Listing the symbols available on disk but not yet referenced in the drawing is accomplished with the SYM/DIR command. Again, the default symbol for the next reference insertion can be set by clicking the desired symbol file name on the listing. The LIST and DIR options relieve the user from remembering the symbol names exactly.

The REPL option changes a symbol reference from one symbol definition to another. With REPL, a drawing of a computer system board layout based on 64KB memory chips could be modified to show 256KB chips with a single command. REPL operates on all symbols in a window that match the name that is furnished by the user.

Because CADVANCE does not make its symbol definitions a permanent part of the drawing database, one instance of a symbol cannot be edited without affecting all other occurrences of that symbol in all other drawings. CADVANCE does, however, provide a straightforward method to edit a single instance of a symbol. Any symbol reference can be replaced with the elements of the symbol definition, using the SYM/XPND command. Once a symbol has been expanded, it can be edited as can any other group of drawing primitives.

The last option to the SYM command is COUN. It allows the user to switch to a text screen and display a list of symbols included in the drawing, along with a count of the references.

MACRO FACILITY

Several leading CAD packages provide programming facilities so the user can write routines to customize a system. The symbol library, containing commonly used symbols with meaningful names, allows some customization. Certain situations, however, require non-standard symbols, but standard sequences of events, or procedures.

Drawing stairs is a standard procedure. Three variables determine the configuration of the stairs: the height of the riser, the top surface of the step, and the number of steps. These variables determine the horizontal length of the stairs, the overall height of the stairs, and the angle of the stringer that carries the treads. People expect stair steps to be about 7 inches— $6\frac{3}{4}$ to $7\frac{1}{4}$ inches is a good range. A difference of an inch between one step and another can be a tripping hazard.

C-terp

The C
Interpreter
You Won't
Outgrow



C-terp will grow with you as you progress from novice through professional to guru. Unbelievable, but true, the easiest-to-use C interpreter will provide you with the most advanced programming features for upward growth. Our exclusive **object module support** enables you to add libraries (like HALO, PANEL, Windows for C, etc., or your own homebrew libraries) to C-terp as you add them to your computing repertoire. Use C-terp as a microscope on your libraries! Flip a bit and allow our **software paging** (NEW) to handle those big jobs! There are no fixed-size tables to overflow, and C-terp can be configured for different screens and screen adapters (NEW). With multiple modules and full **K&R support**, we offer a dream C environment.

- Our new improved **configurable editor** competes with anything going.
- Speed -- Linking and semi-compilation are breathtakingly fast.
- Convenience -- Errors direct you back to the editor with the cursor set to the trouble spot.
- Symbolic Debugging -- Set breakpoints, single-step, and directly execute C expressions.
- Compatibility guaranteed -- batch file to link in your compiler's entire library. Supported compilers include: Computer Innovations C86, Lattice C, Microsoft C 3.0, Mark Williams C86, and Aztec C.
- Many more features including batch mode and 8087 support.

What Our Users/ Reviewers Are Saying

"...easy to use, powerful, and a timesaver."
"...we absolutely LOVE C-terp."
"...has restored my faith in interpreters."
"...a programmer's dream."
"...wonderful technical assistance."
"...increased our productivity by a factor of 40."
"...the best C product ever, in any category."

● Price: \$300.00 (Demo \$45.00) MC, VISA

Prices include documentation and shipping within U.S. PA residents add 6% sales tax.
Specify compiler.

- C-terp runs on the IBM PC (or any BIOS compatible machine) under DOS 2.x and up with a suggested minimum of 256 Kb of memory. It can use all the memory available.

* C-terp is a trademark of Gimpel Software.

GIMPEL SOFTWARE

3207 Hogarth Lane • Collegeville, PA 19426
(215) 584-4261

Turbo, who?

Do you have to give up power and advanced potential to get ease of use and affordability? Not anymore. Because now, you can have UCSD Pascal for only \$79.95!

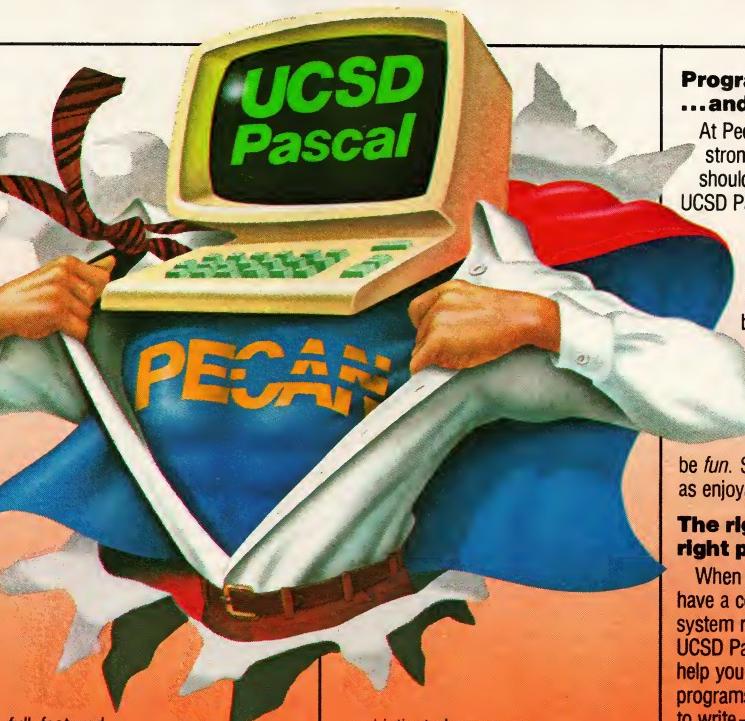
If you're making your move into programming, there's no better way to go than Pascal. And starting now, you don't have to settle for a stripped-down version of Pascal in order to get a price that's right. Instead, you can choose UCSD Pascal—the recognized Pascal programming standard in colleges and universities throughout the country—at the incredibly low introductory price of \$79.95 for your PC-DOS, MS-DOS, or other popular computer.

Start with the standard

With an *entry-level* system, you spend a lot of valuable time learning a *non-standard* form of Pascal. And you don't get all the capabilities a true Pascal system is supposed to deliver—unless you buy a lot of add-on utilities—which can send the cost of your system sky-high! Worst of all, when you're ready to tackle anything more than short, simple programs—you have no choice but to move up to a more sophisticated system (like UCSD Pascal). And at that point, you also have to *relearn* standard Pascal.

UCSD Pascal has everything you need

With UCSD Pascal, you get a



full-featured, professional programming tool that's being used right now in the development of major scientific and business applications. The system comes with an outstanding text editor, a complete on-line tutorial, 8087 math coprocessor support and BCD (decimal arithmetic) included in the package at no extra cost. In fact,

UCSD Pascal contains virtually everything you need—as standard equipment—for developing the simplest to the most

sophisticated programs.

UCSD Pascal is available for MS-DOS, PC-DOS, UNIX, VMS, MSX and many other operating systems. You can use UCSD Pascal to write programs of any size on virtually any computer, and port them to any other computer. And if speed is what you're after, the latest native code version of UCSD Pascal actually benchmarks favorably with Turbo Pascal® in execution time!

Programming that's easy...and fun!

At Pecan Software Systems, we strongly believe programming should be as easy as possible. UCSD Pascal was originally designed for teaching programming skills, so it's extremely easy to learn and to use. With UCSD Pascal, you'll be developing programs right from the start that are easy to write, easy to understand, and easy to maintain. We also believe that programming should be fun. So we've made UCSD Pascal as enjoyable to use as it is powerful.

The right tool at the right price

When the fun gets serious, you'll have a comprehensive programming system right at your fingertips with UCSD Pascal—a system that will help you develop those big-league programs you may eventually want to write—at a price you can readily afford.

Put UCSD Pascal programming power on your PC now for only \$79.95! Order by mail today or phone now 1-800-63-PECAN. UCSD Pascal—the original standard of Pascal programming excellence. The new leader in Pascal price/performance.

PECAN™

The UCSD Pascal Company
Pecan Software Systems, Inc.
1410 39th Street, Brooklyn, NY 11218
718-851-3100

AMIGA is a trademark of Commodore Electronics LTD.

APPLE & MACINTOSH are trademarks of Apple Computer.

ATARI 520 is a trademark of Atari Corporation.

RAINBOW is a trademark of Digital Equipment Corporation.

TANDY is a trademark of Radio Shack.

Turbo Pascal is a registered trademark of Borland International.

UCSD Pascal \$79.95 (for PC-DOS, MS-DOS, AMIGA, APPLE, ATARI 520, MACINTOSH, RAINBOW, TANDY, as well as most popular 8/16/32-bit systems).

Price includes 8087 support and BCD.

Please send me _____ copies of UCSD Pascal for my _____ (Name and model of computer).

My disk size is 3 1/2" _____ 5 1/4" _____ 8" _____.

Total amount (NYS add appropriate tax) _____.

Payment by VISA MC US Bank Check Bank Draft

Card Number: _____ Credit Card Expiration Date: _____

UCSD Pascal is a registered trademark of The Regents of University of California

Not copy protected
60-day money-back guarantee

Mail to: Pecan Software Systems, Inc.
1410 39th Street
Brooklyn, NY 11218
ITT Telex No. 494 8910
CompuServe Code 76703, 500

CREDIT CARD ORDERS
CALL TOLL-FREE
1-800-63-PECAN
(NYS) 1-800-45-PECAN

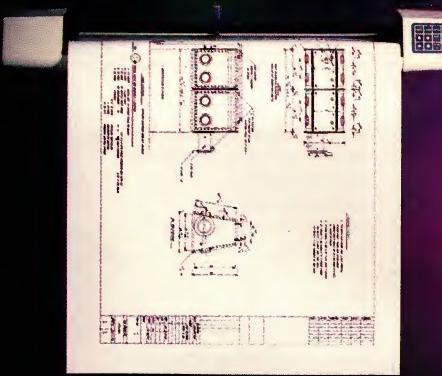
Name _____
Shipping Address _____ State _____ Zip _____
City _____
Telephone _____

Call or write for UNIX, VAX or other UCSD Pascal versions—and ask about our powerful Pascal add-ons, too. SCHOOLS: Contact us for our special educational discounts!

Call toll-free or enclose a check with this coupon to place an order. Please add \$2.50 for shipping within the US. Foreign orders add \$10 and make payment by bank draft payable in US dollars on US bank. New York State residents add appropriate sales tax.



THE NO FRILLS PLOTTER



Enter the world of professional CAD applications with Houston Instrument's low cost DMP-41/42 series plotters. These single-pen plotters give you the features you need—C and D size plots, extensive software compatibility, and proven reliability—for a very affordable no frills price of \$3295.*

The DMP-41/42 series' large C and D size formats are ideal for a wide range of CAD applications, from architectural elevations to assembly drawings. And a .005 inch resolution ensures crisp drawings on a variety of media—paper, matte film, or vellum.

With the DMP-41/42 series, you can choose from an impressive selection of off-the-shelf graphics software packages such as VersaCAD, AutoCAD, and CADKEY. Or, by using Houston Instrument's popular DM/PL™ language, you can create your own custom software and be assured of upward compatibility with Houston Instrument's entire line of plotters.

The DMP-41/42 series. The plotters that offer superb reliability, comprehensive graphics capabilities, and a no frills price. The proven performers for low-cost CAD.

For more information, call

1-800-531-5205 (512-835-0900 if in Texas), or write Houston Instrument, 8500 Cameron Road, Austin, Texas 78753. In Europe, contact Houston Instrument, Belgium NV., Rochesterlaan 6, 8240 Gistel, Belgium. Tel.: 32-(0)59-277445. Tlx.: 846-81399.

*U.S. suggested retail price. Pricing subject to change. DM/PL is a trademark of Houston Instrument.

**houston
instrument**

A Division of **AMETEK**

CADVANCE

- A reasonable procedure for laying out a staircase is as follows:
- Determine the overall height—from floor to floor or floor to landing.
 - Divide the overall height by 7 inches to arrive at the number of steps.
 - Round off the number of steps to an integer value.
 - Divide the overall height by the integer number of steps to obtain the exact height of a riser.
 - Multiply the number of steps by 11 inches to obtain the overall horizontal length of the staircase.
 - Adjust the overall length if necessary and divide the adjusted length by the number of steps.
 - Divide the overall height by the overall horizontal length and take the arctangent to determine the angle of the stringer—check angle for code or safety procedure compliance.

This staircase example represents sequences of operations that can easily be programmed, but that are inappropriate for inclusion in a CAD system as built-in commands. A system including such features would become unwieldy because of the number of commands it would incorporate; furthermore, such a system would be overly specialized for effective marketing.

A CAD program that handles only primitive objects would not relieve the designer of much work in the task of laying out a staircase. Nor would a symbol handling feature be of great help unless the library included several symbols, each with a different number of steps, and could insert symbols at independently variable X and Y scales. Still, arithmetic would be required to determine the number of steps.

CADVANCE provides a macro facility to this end and devotes more than 50 pages of the manual and several appendices to its coverage. A macro is simply a sequence of legal CADVANCE commands and macro programming language (MPL) expressions and functions. The manual posts a warning that some general knowledge of programming is required to use MPL. However, it seems to be quite straightforward in comparison with general purpose programming languages or with macro facilities of other programs—CAD, spreadsheet, etc. And, like other macro facilities, this one requires thorough knowledge of the program's operation.

Macros are invoked with the main menu MACR command, which displays four options on the prompt line: BEGIN, END, RUN, and KEY. MACR/RUN invokes a macro. CADVANCE includes 11 macro files that illustrate various points

of macro programming. Some are interactive, requiring user input; others are one-word replacements for command sequences. One example addresses the stair problem. It prompts the designer for the maximum rise per step, maximum horizontal overlap, stair width (tread depth), stair (tread) thickness, minimum rise, handrail height, the bottom point, and top of landing. It computes the step rise and requests verification that the rise is acceptable. If the rise is accepted, the program draws the steps, handrail, and the front edge of

the stringer, leaving the sizing of the stringer to the designer (photo 4).

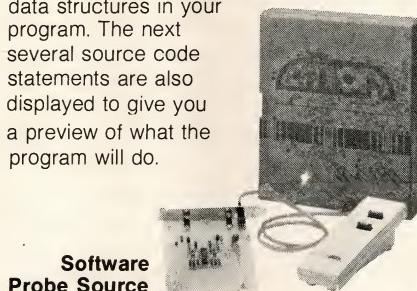
The stair macro is stored in a disk file called STAIR.MAC, which is read each time the macro is executed. Thus, the system can be extended with a large number of macros—with no sacrifice in drawing database storage. The actual code for the stair macro is 110 lines long and requires a minute or so for execution, depending on the speed with which the user supplies input. The same process performed manually could take as much as an hour.

Why debug your Program in Assembly Language when you wrote it in one of these...

Without source level debugging, the programmer must spend time mentally making translations between assembly language and the C or Pascal in which the program was written. These tedious translations burn up valuable time which should be spent making critical product schedules. Lower level debugging tools are superseded by Atron's **SOFTWARE SOURCE PROBE**. This is the debugging tool used by professionals. Why? — Because it has the features they need to solve complex debugging problems. **SOFTWARE SOURCE PROBE** has the same command interface as the Atron hardware assisted software debuggers — so you can fill your lab with compatible debugging tools and minimize new learning.

How To Single Step Your Source Code And Keep Critical Data In View

With **SOFTWARE SOURCE PROBE**, you can step your program by source code statements. While stepping, a window which you define can display critical high level data structures in your program. The next several source code statements are also displayed to give you a preview of what the program will do.



How To Display Data In Meaningful Formats

Why look at program data in hex when you defined it to be another data type in your program. **SOFTWARE SOURCE PROBE** provides a formatted print statement to make the display of your variables look like something you would recognize. You can specify data symbolically, too.

CIRCLE NO. 249 ON READER SERVICE CARD



Solving The Tough Bugs

When the others fail, **SOFTWARE SOURCE PROBE** keeps on debugging. When you need isolation between the debugger and the program — you get screen switching, dual monitor support, or you can run the debugger from a totally separate CRT. When you need to get out of a program lock up state — you get recovery through the optional crash recovery switch box. When you want to trace a procedure calling sequence — you get a command to unthread stack nesting. When you want conditional sequential breakpoints — you get powerful LOOP, LOOP COUNT and IF/THEN/ELSE debug commands. When you want to build complex command sequences, you get Macro commands. And when you need an affordable debugging tool — you get **SOFTWARE SOURCE PROBE — \$129** **CRASH RECOVERY SWITCH BOX — \$99**. Then when you want to optimize the performance of your program — get Atron's **SOFTWARE PERFORMANCE AND TIMING ANALYZER (also \$129)**. It gives you histograms of your executing program, counts events, and shows you all the execution times of given procedures.



So why waste more time.
Call Atron and
get one of our
BUGBUSTERS
today...

ATRON
THE DEBUGGER COMPANY

20665 Fourth Street • Saratoga, CA 95070 • 408/741-5900

CopyWrite

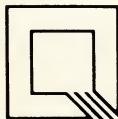
BACKS UP IBM PC SOFTWARE

Hundreds of the most popular copy-protected programs are copied readily. CopyWrite needs no complicated parameters. It needs an IBM Personal Computer, or an XT or an AT, 128k bytes of memory, and one diskette drive. CopyWrite will run faster with more memory or another drive.

CopyWrite is revised monthly to keep up with the latest in copy-protection. You may get a new edition at any time for a \$15 trade in fee.

CopyWrite makes back up copies to protect you against accidental loss of your software. It is not for producing copies for sale or trade, or for any other use that deprives the author of payment for his work.

To order CopyWrite, send a check for \$50 U.S., or call us with your credit card. We will ship the software within a day.



Quaid Software Limited

45 Charles Street East
Third Floor
Toronto, Ontario M4Y 1S2
(416) 961-8243

Ask about ZeroDisk to run copy-protected software from a hard disk without floppies.

CADVANCE

Macros can be nested within other commands if they consist only of commands that can be nested; the display control commands also can be nested within the execution of a macro. For example, if one of the data points required by the stair macro is off the screen, the ZOOM, PAN, or VIEW command can be used to change the display to the user's specification.

A macro file consists of command lines, each beginning with a key word from a set of 17 commands. All key words, except one, are followed by arguments that can be text strings, variable names, register names, expressions, and labels. Two basic branching constructs are available: GOTO...<label> and IF...GOTO...<label>. Structured programming adherents may look upon such inelegant facilities with disdain, but these lowly constructs—unconditional branch and conditional branch—are equal to virtually any programming task.

The first four Event key words—MENU, PNT, KEY, and TEXT—correspond to the types of input the program accepts in its normal mode of operation. MENU takes an argument from the list of commands on the main menu or a submenu. For example, a macro named WALL might include the lines:

MENU DRAW
MENU 2LIN

The effect of selecting MACR RUN WALL would be the same as picking DRAW/2LIN from the screen menu.

PNT takes a point argument—Cartesian coordinates—as if the point had been picked with the pointing device, preceded by a button number, corresponding to the first and second mouse buttons. Point data can be constant values, integer literal—to use the manual's terminology—or variable, using data stored in named register variables. Points can be in the drawing viewport, or they can be selections on the prompt line, corresponding to the options entered from the prompt line.

KEY takes a single character input, surrounded by single quote marks, and TEXT takes a text string as an argument, surrounded by double quote marks.

The second group of key words, called Internal key words, consists of 13 commands that are further divided into four groups: SET, GET, cursor control, and execution control commands.

The SET command assigns values to the register variables mentioned above. These register variables are predefined. One hundred integer registers are available for general use; 100 integer

registers for X coordinate data; 100 integer registers for Y coordinate data; 100 floating-point registers for general use; and 10 character string registers for general use. The manual states that the integer registers are implemented as four-byte registers. However, CADVANCE's drawing database is evidently limited to two-byte values for X and Y coordinates, because the drawing world can be only 60,000 units in either direction.

SET is the command that allows macros to perform calculations on user input and feed the results to other commands. The stair macro, for example, includes 47 SET commands, just under half of the total number of executable statements in the macro.

The argument to a SET command is a register name followed by an assignment sign (=) and an operand, which can be a literal value, another register name, or an expression with operators and multiple operands.

Expressions in a SET command argument can include the traditional arithmetic operators, such as +, -, *, /, and % (modulus or remainder operator for integer division only). No surprises are evident here; traditional operator precedence applies.

In addition to operators and operands, expressions also can use special functions. These functions, all beginning with the @ sign, à la VisiCalc, can do type conversions, find minimums and maximums, perform trigonometric functions, and take square roots.

Five key words are used to obtain data from the user, all beginning with GET—GETI, GETU, GETR, GETS, GETP. These commands get integers, unit-integers (integer values that are in the currently defined units, such as feet and inches), real numbers, strings, and points, respectively. The syntax for each command includes a prompt, which CADVANCE displays on the prompt line when the command is encountered. The syntax for the first three commands includes a maximum allowed value and the register (or registers) in which the user's input will be stored.

The cursor control key words configure the cursor for operations, such as dragging and rubberbanding. Dragging is indicated by a dragging box surrounding the object(s) being dragged, and the rubberband cursor is a line connecting a previously entered point with the point being entered. Normal interactive commands, entered with the pointing device, use rubberbanding or dragging cursors, but MPL allows both.

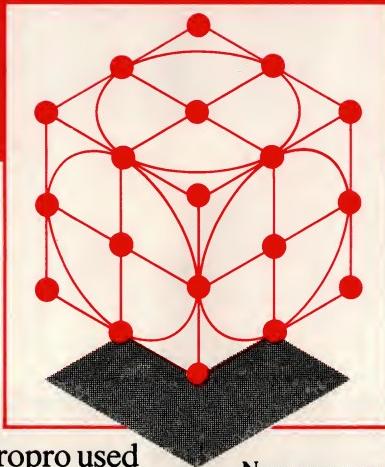
The last group of key words includes the execution control com-

New from Logitech.

MODULA-2/86 VERSION 2.0

Professional Modula-2 for \$89.

Now the same powerful tools Micropro used to develop its latest word processing system is available to you at a new \$89.00 price.



Now you can create your professional software development system using the proven technical sophistication of LOGITECH MODULA-2/86.

Systems to Fit Your Needs.

Base Language System

- Compiler and Linker
- Module Library

\$89

Base Language System/8087

- Inline 8087 code.

\$129

Base Language System/512K

- Full 8087 support.
- Uses RAM to increase speed by 40 to 50 percent.
- 80186 and 80286 support.

\$189

Run-Time Debugger

- Monitors the execution of a program with user-defined breakpoints or by stepping through the program.
- Symbolically displays the source code, data, procedure call chain, and raw memory.

\$69

MODULA-2 Editor

- Fast on-line Modula-2 syntax check.
- Can run compiler and linker from the editor.
- User definable templates for Modula-2 syntax constructs.

\$59

Utilities Package

- Decoders: Disassemble link and load files.
- Version: Administrate different versions of one program.
- Post-Mortem Debugger: Debugs a program after abnormal termination.
- Cross Reference: Produces a cross-reference listing of a Modula-2 program.

\$49

Sources

- Sources to customize your system.
- Run-Time System sources.
- Some library module sources.

\$179

Not Copy Protected

INTRODUCTORY OFFER

Through the end of March you get the new MODULA-2 Editor for free with any purchase of the Base Language System.

To place an order call our special toll free number:

800-231-7717

In California:

800-552-8885

YES, I want to create my professional software development system. Please send me the following building blocks:

BLS \$89 BLS/8087 \$129 BLS/512K \$189
 RTD \$69* EDITOR \$59*
 UTILITIES \$49* SOURCES \$179*

*\$10 less with the purchase of any Base Language System.
Please add \$5 for shipping and handling.

VISA MASTERCARD CHECK ENCLOSED

CARD NUMBER _____ EXPIRATION DATE _____

SIGNATURE _____

NAME _____

ADDRESS _____

CITY _____

STATE _____ ZIP _____ PHONE (____) _____



LOGITECH

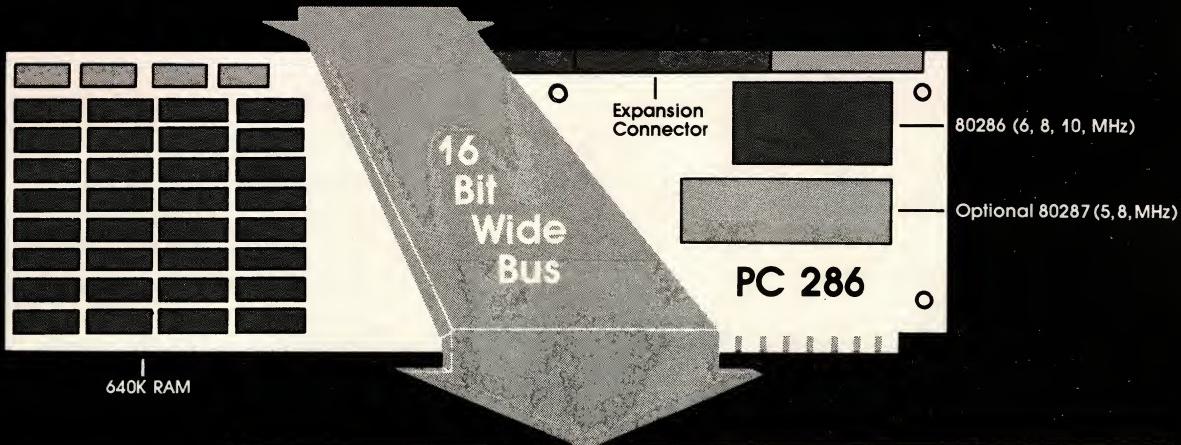
LOGITECH, Inc.
805 Veterans Blvd., Redwood City, CA 94063, USA

Telephone: (415) 365-9852

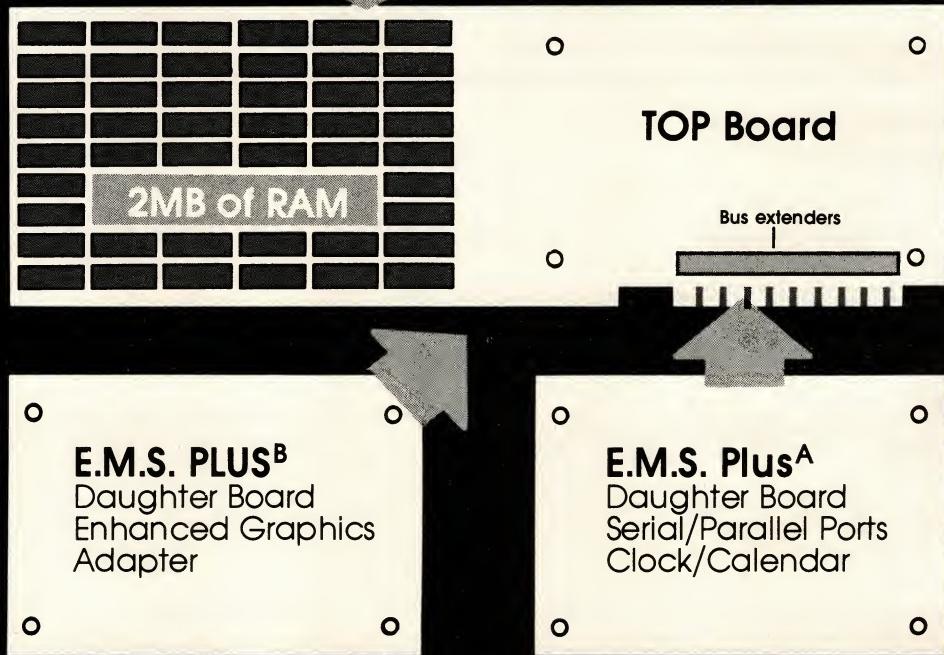
LOGITECH SA
Box 32, CH-1143 Apples, Switzerland
Telephone: 41 (21) 774545

ONLY SEATTLE TELECOM & DATA solves the expanded memory and speed problems of the IBM PC/XT.

- 2MB EMS Memory
- 16 Bit Data (PC-286 Support)
- Both Intel & AST Specifications Support



- Fully compatible with both Lotus/Intel/Microsoft E.M.S. 3.2, and AST/Quadram Enhanced E.M.S.
- 0-2 megabytes expandable memory on one board
- Compatible with Lotus 1-2-3, Version 2.0, Symphony, Version 1.1 and Framework, Version 2.0
- 100% PC-DOS Compatible
- One Year Warranty



Now, you can solve your memory and speed problems with TOP Board™ from Seattle Telecom & Data. **TOP Board** is the only E.M.S. Board to either run 8 Bit or 16 Bit wide in the IBM PC/XT. It is the only board available that can be **powered by the PC-286 card**. Create larger Spreadsheets and Data base files on your IBM PC or compatible, and run programs such as Lotus,™ Symphony™ and Framework™ **three times as fast** as the IBM PC/XT.

The TOP Board is fully compatible with the Lotus/ Intel/

Microsoft Expanded Memory Specification **and** the AST Enhanced E.M.S. specification. TOP Board's unique design provides an efficient and flexible paging scheme for greater performance with E.M.S. applications and multitasking software.

TOP Board offers the flexibility of using 2MB on one board taking up only one slot!!

TOP Board comes with optional daughter boards that give users the flexibility of E.M.S. memory **Plus^A** with a serial/parallel ports and clock calendar* or

E.M.S. memory **Plus^B** with an Enhanced Graphics Adapter.**

TOP Board can be used as a standalone E.M.S. board or it can be driven by the **Powerful PC-286 Accelerator Board**. By connecting the TOP Board with the PC-286 you will have solved the two biggest problems facing microcomputer users — **Memory and Speed!!**

CALL (206) 883-8440



SEATTLE TELECOM
& DATA, INC.
2637 151st Pl. N.E.
Redmond, WA 98052

* Available 1st quarter '86
** Available 2nd quarter '86

CADVANCE

mands, LABL, GOTO, IF...GOTO, EMSG, and EXIT. These make MPL a programming language. LABL defines the location of a label, which is the target for a GOTO statement. GOTO <label> causes an unconditional branch to the line, LABL <label>. IF <logical expression> GOTO causes a conditional branch to LABL <label>—a logical expression is an expression including one of the logical operators, EQ, NE, GT, GE, LT, LE, all familiar to FORTRAN and BASIC programmers. EMSG defines error messages. An EMSG statement will normally be preceded by a LABL statement and followed by a GOTO statement. EMSG displays an error message on the prompt line and waits for the user to press button 1 on the pointing device. When the button is pressed, the next statement is executed—the GOTO statement that returns control to the statement preceding the one that caused the user to make an error.

The MENU key word allows invocation of any command or option that appears in the two menu columns, and the PNT command allows selection of options in the prompt line. However, 31 operations are invoked from the status line—setting the active layer, setting the snap mode, setting text parameters, etc. These operations are performed with the OPC (operation code) key word, in conjunction with the PNT, TEXT, and KEY key words. As with the PNT key word used to set prompt line options, this feature requires intimate knowledge of the status line displays.

CADVANCE's macro facility is powerful enough that its design functions are limited by the user's imagination, not by any limitations of MPL itself. The combination of interactive macro definition and disk storage provides the ability to create large macro libraries, with no effect on drawing storage. Because macros are stored in text form and are interpreted, they do not execute as fast as CADVANCE's built-in commands. However, the speed of execution should not be of any great concern.

DATABASE EXTRACTION

Early microcomputer-based CAD systems incorporated drawing databases that stored only the data required to display the drawings on the screen and to plot them on the plotter. Large CADD systems, on the other hand, provided the user with the ability to attach nongraphic data to drawing objects and to generate various reports based on those nongraphic data.

The ability to manage nongraphic data is one of the two essential features

that make a CAD system eligible for consideration as a CADD system (a macro programming feature is the second). CADVANCE provides this facility in the form of an external program called DBE (for database extraction).

Database extraction depends upon the assignment of attributes to symbols and layers and the assignment of values to attribute-symbol instances. Therefore, a symbol for a light fixture might be assigned the following attributes: WATTS, NO_LAMPS, VOLTAGE, NIGHT, MODEL_NO. A particular instance of that symbol might be assigned the values, 160, 4, 208, yes, 4FR880. None of this information is required to draw the light fixture symbol, but it is all quite relevant to the design.

CADVANCE allows the assignment of attributes to symbols, but not within the drafting program. All database management functions are performed in the DBE program, except for the UTIL/DBE command, which scans the drawing database to produce an attribute data file (*.ADF). The ADF file is an interchange file used to transfer data from the drawing file (.VWF) to an attribute database file (.DBF), which is used by the DBE program to produce reports. Assignment of attributes is similar to the construction of a dBASE II/III database.

The DBE program is invoked directly from DOS. A command line at the top of the screen displays DBE's commands: LOAD, EDIT, APND, DELE, UDEL, LIST, FIND, EXTR, MAKE, INDX, PACK, REPT, and EXIT. Most of the commands are analogous to dBASE II/III commands and are executed by moving the highlight to the desired command and pressing Enter. Alternatively, commands can be executed by pressing the slash (/) key and typing the entire command, not just the first letter as is possible in the drafting program.

A database file structure is created with the MAKE command, which is similar to dBASE II/III's CREATE command. The first two fields in the file are evidently reserved for symbol names and quantities, respectively. Any remaining fields are used to store attributes attached to the symbols.

Attribute values are assigned via the REPT command, which displays a submenu of five commands. The REPT feature provides a JOB file facility similar to that of a dBASE II/III command file. The three basic JOB files are Report, which controls the format of printed or displayed reports; Index, which controls the generation of index files from database files; and Calc, which fills attribute fields with data calculated from the con-

FREE! UNIX for the PC!

(WITH ANY PURCHASE OF \$250 OR MORE BEFORE 3/26/86)



LIBRARY: 325 fully tested functions
screen handling/graphic, cursor/
keyboard/data entry, string handling,
status and control, utility/DOS/BIOS/
time/date, printer control.
4 disks, 400 page manual \$129.95

WINDOWS: The most powerful
windowing package available,
overlays, borders, pop-up menus/
help windows, zap instantly on/off
screen, status lines, horizontal/
vertical scrolling, color control/
highlighting, word-wrap, files to
windows, keyboard to windows
3 disks, 225 page manual \$129.95

SUPERFONTS FOR C: Dramatic,
high impact screens. Use our
character & image libraries and
functions, or create your own.
Font & Function Library \$49.95

B-TREE LIBRARY: Fast indexing
B-tree. 16 million each: keys and
records, unlimited keys per file,
variable length records. PC-DOS,
UNIX, XENIX, CP/M. \$79.95

ISAM DRIVER: \$49.95

COMPATIBILITY: PC/XT/AT; Full
K&R, Cl-C86/De Smet/Lattice/
Microsoft 3.0/Aztec/others.

VALUE: All source code, No royalties.
Best documentation available.

No matter what else
you have, you need these.

C-TERP: Simply the best C
interpreter available. See C Journal
Summer 1985
C-TERP (specify compiler) \$299.95

PC-UNIX: Multi-tasking, networking
multi-user. With source code \$99.95

COMBINE AND SAVE!

C LIBRARY plus C WINDOWS	\$179.95
BOTH for only	\$179.95
+ SUPERFONTS FOR C	\$199.95
+ B-TREE and ISAM	\$299.95
(A \$440 VALUE)	
C LIBRARY plus C WINDOWS	
+ SUPERFONTS	
+ C-TERP (a \$610 value)	\$459.95
All (a \$740 value)	\$549.95

Entelekon

CIRCLE NO. 158 ON READER SERVICE CARD

12118 Kimberley, Houston, TX 77024

713-468-4412

VISA MASTERCARD CHECK COD

CADVANCE

tents of other fields. A fourth JOB file, the DBE Batch file, controls the execution of the three basic JOB file types.

A report can be created from a drawing in the following way:

- A drawing is created incorporating symbols for objects to which non-graphic attributes are attached.
- The UTIL/DBE command creates an .ADF file, which contains the quantities and names of symbols referenced and layers defined in the drawing.
- DBE is invoked after the user exits the drafting program.
- The user creates an empty database file, with a structure that includes a field for symbol names, one for quantities, and any other attributes of interest, using the DBE MAKE command.
- Records are appended to the empty database file using the DBE APND command. One record is appended for each symbol referenced.
- The count field of each record is updated with the EXTR command, which reads the ADF file created from within the drafting program.
- The user creates Report, Index, and Calc JOB files in order to control the calculation of attribute field values and a DBE Batch file in order to control the execution of the Report, Index, and Calc files.

The user executes the DBE Batch file, producing the report.

CADVANCE's DBE facility can perform inventory tracking, facility planning, and material takeoff for cost estimating. The system can accomplish three basic tasks from within the drafting program, from which considerable additional information can be derived using the DBE program. The system counts symbols by name, accumulates the length of lines on a layer, and calculates the area of each window defined. These tasks can be performed for the entire drawing or for multiple windows.

Given symbol counts, equipment and devices can be priced. Given line lengths per layer, material can be priced on a per length basis. Further, given the area of a window, total costs can then be converted to cost per square unit, and unit area costs can be extended to total costs.

Although the DBE facility adequately performs the basic tasks of non-graphic database management, some users will wish to perform more complex tasks or use the database in a more interactive manner. Because the DBE files are in dBASE II format, complex processing tasks can be handled with dBASE II programs. Alternatively, the nongraphic database can be designed

with dBASE II and only the extraction from the .ADF files to the .DBF files need be accomplished with DBE.

In fact, almost any program that uses dBASE II file formats should be usable with the DBE files. The interactive tasks can be addressed with Lotus 1-2-3, using the 1-2-3 translator program to translate the .DBF files to Lotus .WKS files. Then, the database can be massaged in spreadsheet form.

The DBE facility is not without some limitations. Because nongraphic attributes cannot be defined within the drawing database, but must instead be defined in external database files, symbol instances cannot be assigned various attribute value pairs. That is, a symbol for a chair may be assigned a COLOR attribute and a value of RED for that attribute in the .DBF file. However, the same CHAIR symbol cannot be assigned another color. Only the number of instances is exported from the drawing database file for use with the DBE facility. Thus, in order to use DBE for interior design as well as for facility management, the symbol library must include not just one symbol for chairs, but several symbols—RED-CHR, BRN-CHR, GRN-CHR, etc.

Nevertheless, the ability to extract line lengths by layer is a powerful fea-

Cross Compiler 68000/08/10/20

Features:

- Full, Standard C
- Easy to Use Compiler Options
- Complete User Documentation
- Global Code Optimization
- Optional Register Allocation Via Coloring
- ROMable and Reentrant Code
- Comprehensive Royalty Free Run-time Library
- Floating Point Library Routines
- Intermix MCC68K C with ASM68K Assembly Language or Microtec PAS68K Pascal
- Optional Assembly Language Listing Intermixed with MCC68K C Source Line Number
- Symbolic Debug Capability

The Microtec MCC68K C Cross Compiler is a complete implementation of the 'C' programming language as defined in *The C Programming Language* by Kernighan and Ritchie with extensions.

MCC68K emits highly optimized assembly language code for the Microtec ASM68K Motorola compatible assembler.

The Microtec MCC68K package includes the compiler, relocatable macro assembler, linking loader, run-time library, and comprehensive user's guide.

Position Independent Code
Now Generates:
Position Independent Code

Host computers include: DEC VAX, DG MV-Series, Apollo, IBM PC and PC-compatibles..

We're Functional and Fast and Serious about our products. We've been providing flexible and economical solutions for software developers since 1974.

Beginning with product concept, through development, quality assurance, and post-sales support - Quality, Compatibility and Service are the differences which set Microtec Research apart from others.

If you're a serious software developer, shopping for software development tools, call or write today for more information:

800-551-5554,
In CA call (408) 733-2919.

3930 Freedom Circle, Suite 101, Santa Clara, CA 95054
Mailing Address: P.O. Box 60337, Sunnyvale, CA 94088

 **MICROTEC®
RESEARCH**

LAN

Power

...FOR THE PRODUCTIVITY MINDED.

MDBS III

Absolute Power

Add real power to your local area network with MDBS III LAN. These features will give you productivity like you've never had before—

- Recovery and transaction logging
- Active and passive locking of records (not just files)
- Formalized structure report writing
- Debugging for the application developer
- 27 host programming languages to call subroutines
- SQL query language
- Forms development tools
- Multiple data structure support—including relational, network and hierarchical
- Unsurpassed speed

The MDBS III LAN is unrivaled. Get its power today. Available for networks from Nestar Systems, Novell, 3Com, and IBM under PC DOS, and from 3Com for Texas Instruments.



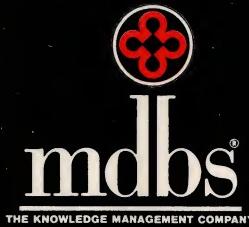
Get everyone in your department in on the universal knowledge management system, KnowledgeMan/2.

From data management to spreadsheet to statistical analysis, KnowledgeMan/2 is ready. Share your resources, consolidate your applications, programs, utilities and data with the most advanced integration available. KnowledgeMan/2 LAN allows several users to share a data base and still protect data integrity.

Help your department become more efficient and productive. KnowledgeMan/2 generates the power—LAN distributes it.

KnowledgeMan/2 LAN versions are available for networks made by Novell, 3Com and IBM.

Get the power of LAN with MDBS III, KnowledgeMan/2 or both. MDBS III and KnowledgeMan/2 can even be used together, for phenomenal application development power.



Micro Data Base Systems, Inc. • P.O. Box 248 • Lafayette, IN 47902 • 317/463/2581 • Telex 209147 ISE UR

CIRCLE NO. 207 ON READER SERVICE CARD

KnowledgeMan/2, MDBS III, mdb and their respective logos are registered trademarks of Micro Data Base Systems, Inc. 3Com is a registered trademark of 3Com Corp. IBM and PC DOS are trademarks of International Business Machines. MSDOS of Microsoft, Novell of Novell, Inc. ©1985, Micro Data Base Systems, Inc.

CADVANCE

ture. It allows users to make quantity takeoffs of any type of material that can be measured in linear units. The most likely limitation in this connection is the number of layers. In order to perform a completely automatic takeoff of electrical wire and conduit, for example, a layer would be needed not only for each size of conduit, but for every combination of conduit size, conductor size, and number of conductors in a conduit. A large building with conduit sizes ranging from $\frac{3}{4}$ inch to 3 inches, wire sizes from 14 AWG to 3/0 (or larger), and from 3 to a dozen or so conductors per conduit run would quickly exhaust the 127 layers available. The other limitation is that electrical designers normally do not draw all conduit/conductor runs, only main feeder runs and enough branch circuit wiring to illustrate circuiting—with "home runs" indicated schematically.

The newest version of CADVANCE makes the database interchange facility separate to the main program and has to be purchased separately to CADVANCE.

SUITABLE PRODUCT

CADVANCE is suitable for production drafting, with the exception that the integer drawing database structure, currently limited to 16-bit coordinates, may

force a trade-off between drawing size and resolution in the database. The plotting facility is excellent, as it should be coming from CalComp, and drawing production is paramount. For a newly introduced package, CADVANCE supports a fairly wide variety of graphic peripherals, and CalComp has indicated it intends to expand that support.

The documented programming language MPL provides users and third-party vendors with an effective means of customizing the package for specific disciplines and fields. MPL can speed the execution of repetitive tasks and automate some design tasks related to the drawing process. However, the lack of a custom menu facility detracts from the potential of MPL. CADVANCE would be much more attractive if custom menus could be displayed on the screen. The integration of command menus into the basic program structure complicates a third-party vendor's efforts to customize the program so that the vendor's enhancements are obvious. The only interface to the enhancements is through the SYM and MACR commands. The menu is still obviously CADVANCE. Whether third-party vendors rally to CADVANCE remains to be seen.

The Database Extraction facility endows CADVANCE with database man-

agement and report generation features that are normally associated with larger systems. Because the DBE program is based on the dBASE II file structure, users and third-party vendors are able to extend the database management side of the program. The choice of the dBASE II database file structure provides a means of exporting drawing-related attributes to a large number of other programs—for the performance of tasks CADVANCE cannot handle.

The product seems to owe at least part of its heritage to Personal CAD System's CADPLAN, even though CalComp maintains that CADVANCE is a completely new program. Nonetheless, CADPLAN users looking for an upgrade should welcome the resemblance between the two programs and adapting to CADVANCE will be relatively painless.

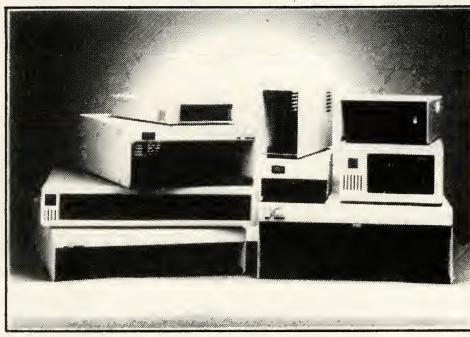
CADVANCE: \$2,500
CalComp, Personal Systems Unit
200 Hacienda Avenue
Campbell, CA 95008
408/370-5109
CIRCLE 361 ON READER SERVICE CARD

Victor E. Wright is the manager of process engineering at Luckett & Farley, located in Louisville, Kentucky. He has written two books that deal with CAD and software.

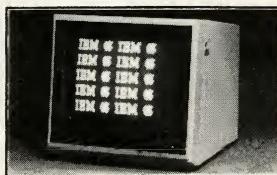


39 Everett Dr., Bldg. D
Lawrenceville, N.J. 08648

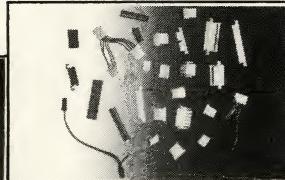
Floppy Disk Services, inc. has been serving the computer community for 6 years now. We offer the best in products and service for the professional and hobbyist alike. Organizations like NASA, RCA, AT&T and IBM who demand quality are among our valued customers. Our techs can custom assemble virtually any special cabling or enclosure set-up you may need. We offer an enclosure line that has sold thousands over the years and our replacement warranty policy puts us out front... We are among the first to offer 8 inch double sided drive systems that run on the IBM-PC/XT for interchangability standards from mainframe to micro.



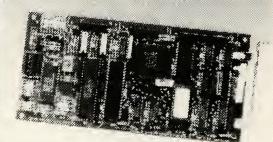
Mitsubishi 4851 DS/DD 48 tpi.....	\$139.
Mitsubishi 4854 1.6mb AT drive	\$185.
10 megabyte system	\$495.
20 megabyte system	\$595.
40 megabyte system	\$995.
130 watt pc supplies	\$ 95.
XT motherboards.....	Call
Western Digital controllers	\$165.
Taxan 415 RGB monitors	\$299.
Teac 55F 80 track drives	Call



Taxan monitors (built for ACORN) \$299.



All our connectors and adaptors are crimped on AMP certified equipment!



AST, Quadram and Western digital boards available!

We offer many more products than space allows. Please call for FREE catalog or let one of our expert staff help you make the right choice, and the call is on us!

"...(Floppy Disk Services) is one of the few mail order houses that enthusiastically does custom work; the technicians there can assemble virtually any desired floppy or hard disk system to order..."

Jeff Duntemann
Technical Editor, PC Tech Journal



Toll Free Order Line: 1 (800) 223-0306



CIRCLE NO. 163 ON READER SERVICE CARD

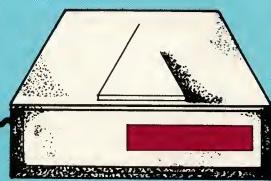
Carbon CopyTM

The ultimate remote solution !

Finally, an acceptable way to run personal computers remotely. Carbon Copy is a powerful software tool which allows you to instantly

connect your PC with any other PC. Once connected, run any program you wish. Application programs, hardware or software diagnostics, utilities, or any other PC program of your choice can be used remotely with Carbon Copy.

TELEPHONE
LINES



ORIGINATE MODEM

- Carbon Copy™ has many uses. Originally, it was developed for use in major corporation support departments, where it has saved thousands of hours in needless telephone calls. Now, the support personnel can SEE what the problems are, INSTANTLY. No more wasting valuable, productive time in unnecessary endless conversations with an inexperienced user trying to describe a highly technical problem.

- Many major corporations use Carbon Copy as a training tool. They simply call up their remote user (a client, a customer, or perhaps a branch office) and proceed to demonstrate how to use the custom software package developed in-house by their programming staff. The remote user is able to ask and answer questions, working with the training staff in real time, without any staff having to leave their own office.

LOCAL PC



- When Carbon Copy links the two computers, their screens and keyboards are linked as one. Any keystroke entered on either PC is displayed, in its proper position, on both systems. Anything you could do sitting in front of your computer, you can do on the remote computer, except change a floppy disk!

**Meridian
Technology** //

1101 Dove Street, Suite 120
Newport Beach, CA 92660
(714) 476-2224

CIRCLE NO. 139 ON READER SERVICE CARD

The personal computer that raised high performance to new heights.

If you work with high volumes of information, you need answers fast.

You need a personal computer that's up to the task.

Which is why IBM created the Personal Computer AT® system. It's changed a lot of ideas about business computing.

The idea of "fast" has become much faster. The idea of "data capacity" has become far greater.

There are new definitions of "power" in a stand-alone PC. While phrases like "sharing files" and "multi-user systems" are being heard more often.

And surprisingly, words like "affordable" and "state-of-the-art" are being used *together*.

Clearly, the Personal Computer AT is different from anything that came before. And what sets it apart can be neatly summed up in two words.

Advanced Technology.

If you've ever used a personal computer before, you'll notice the advances right away.

To begin with, the Personal Computer AT is extraordinarily fast. That's something you'll appreciate every time you recalculate a spreadsheet. Or search through a data base.

It can store mountains of information — literally thousands of pages' worth — with a single "hard file" (fixed disk). And now you can customize your system to store up to

30,000 pages with the addition of a *second* hard file.

The Personal Computer AT runs many of the thousands of programs written for the IBM PC family. Like IBM's TopView, the program that lets you run and "window" several other programs at once.

Perhaps best of all, it works well with both the IBM PC and PC/XT. Which is welcome news if you've already made an investment in computers.

You can connect a Personal Computer AT to the IBM PC Network, to share files, printers and other peripherals with other IBM PCs.

You can also use a Personal Computer AT as the centerpiece of a three-user system, with your existing IBM PCs as workstations.

Most important, only the Personal Computer AT offers these capabilities *and* IBM's commitment to quality, service and support. (A combination that can't be cloned.)

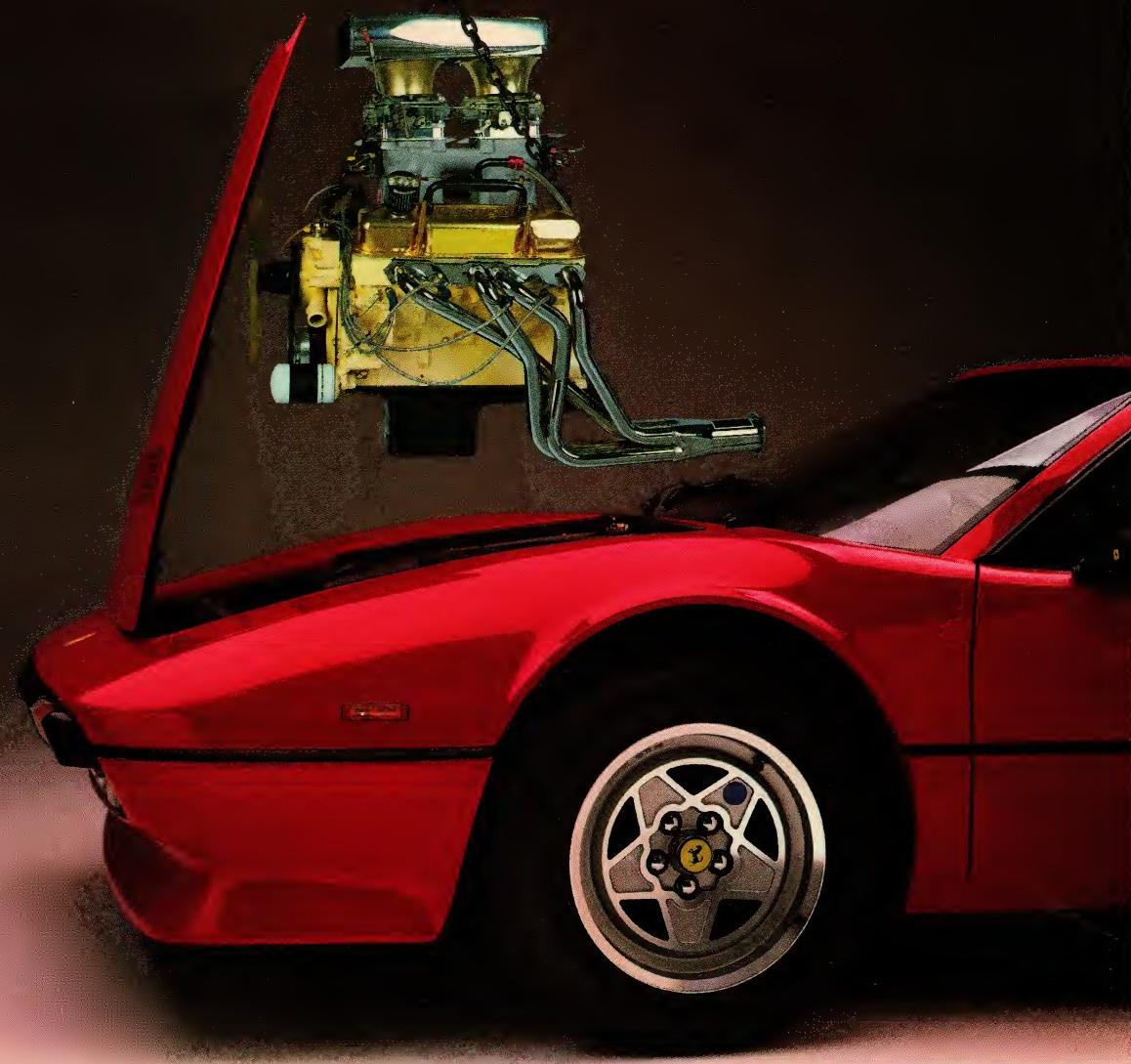
If you'd like to learn more about the IBM Personal Computer AT, see your Authorized IBM PC Dealer, IBM Product Center or IBM marketing representative. For a store near you, call 1-800-447-4700 (in Alaska, call 1-800-447-0890).

The IBM Personal Computer AT, for Advanced Technology.



CIRCLE NO. 248 ON READER SERVICE CARD

©Copyright IBM Corporation 1985



AT™ Pfantasies for your PC or XT.™

Want better speed and memory on your PC or XT without buying an AT?

You've got it!

Phoenix's new Pfast286 co-processor board turns your PC or XT into a high-speed engine 60 percent faster than an AT. Three times faster than an XT. It even supports PCs with third-party hard disks. But that's only the beginning.

You can handle spreadsheets and programs you never thought possible. Set up RAM disks in both 8088 and 80286 memory for linkage editor overlays or super-high-speed disk caching. All with Pfast286's 1mb of standard RAM, expandable to 2mb, and dual-mode design.

You can develop 8086/186/286 software on your XT faster. Execute 95 percent of the application packages that run on the AT, excluding those that require fancy I/O capabilities your PC or XT hardware just isn't designed to handle. Queue multi-copy, multi-format print jobs for spooling. Or, switch to native 8088 mode to handle



hardware-dependent programs and back again without rebooting. All with Pfast286's compatible ROM software. And, Pfast286 does the job unintrusively! No motherboard to exchange. No wires to solder. No chips to pull. Just plug it into a standard card slot, and type the magic word, "PFAST."

If you really didn't want an AT in the first place, just what it could do for you, call or write: Phoenix Computer Products Corp., 320 Norwood Park South, Norwood, MA 02062; (800) 344-7200. In Massachusetts, 617-762-5030.

Programmers' Pfantasies™
by

Phoenix

XT and AT are trademarks of International Business Machines Corporation. Pfast286 and Programmers' Pfantasies are trademarks of Phoenix Computer Products Corporation. For the Ferrari aficionado: yes, we know this is a rear engine car. We are showing the addition of a second engine to symbolize how Pfast can be added to your PC or XT to increase performance.

In the ISPF Tradition

Three of these four PC-based SPF editors offer a more or less full-function implementation of the IBM mainframe's powerful ISPF capabilities.

RUDY S. SPRAYCAR

Software products for editing in the IBM mainframe and microcomputer environments can be divided into three categories: line editors, full-screen text editors, and full-fledged word-processing packages. Line editors are intended primarily for the writing and editing of programs. Such editors for the IBM mainframe include IBM's TSO Edit and ADR's ROSCOE. For the IBM PC, DOS EDLIN is the archetypal line editor. Typically these products edit line by line. They are cumbersome for preparing text for documentation and they are sometimes difficult to use to produce the line indentations required in structured coding.

Full-function word processors, on the other hand, are designed to write text in paragraphs, to cut and paste, and often even to produce automatic pagination, indexing, tables of contents, and other functions desirable in preparing documentation, articles, and correspondence. Whereas line editors are

COMPUTER GRAPHIC • NATALIE EAST





How to make IBM's most powerful personal computer even more powerful.

PLUG IN QUADBOARD® AT

Quadboard®-AT, a sophisticated combination of multifunctions and expanded memory.

Quadboard-AT unlocks the full potential of the PC AT, to make IBM's most powerful personal computer even more powerful.

POWERFUL MULTIFUNCTIONS WITH EXPANDED MEMORY.

Quadboard-AT begins with a printer port and two communications ports. Add on printers, modems, or other communications devices in a snap. And because Quadboard-AT features expanded memory, you can take full advantage of the AT's™ powerful RAM capabilities. Add from 128K to 3.5 megabytes of extra memory to process information faster and more efficiently than ever before.

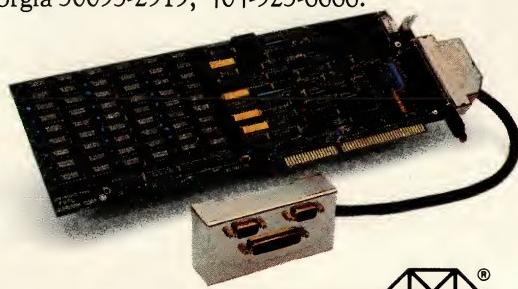
QUADBOARD-AT	AST ADVANTAGE!™
<input checked="" type="checkbox"/> EXPANDED MEMORY. Fully compatible.	<input type="checkbox"/> EXPANDED MEMORY. Incompatible.
<input checked="" type="checkbox"/> FEATURES. Two serial ports standard.	<input type="checkbox"/> FEATURES. One serial port standard.
<input checked="" type="checkbox"/> RELIABILITY. Two year warranty.	<input type="checkbox"/> RELIABILITY. One year warranty.
<input checked="" type="checkbox"/> VALUE. The choice is obvious.	<input type="checkbox"/> VALUE. Less for the money.

COMPATIBILITY FOR THE FUTURE.

With Quadboard-AT, you get full compatibility with the expanded versions of all your favorite software. Like Lotus 1-2-3™, Symphony™, and Windows®. While other boards lock you in to the 640K DOS limit, Quadboard-AT gives you freedom to grow. Now and in the future.

THE BOTTOM LINE IS VALUE.

Quadboard-AT comes with QuadMaster® III utility software and a two year warranty (1.5 Mb versions). No other AT board on the market delivers more for the money. Visit the Quadram® dealer nearest you to get the full story on this powerful new enhancement. Or contact us at One Quad Way, Norcross, Georgia 30093-2919; 404-923-6666.



QUADRAM
An Intelligent Systems Company

CIRCLE NO. 154 ON READER SERVICE CARD

Lotus 1-2-3 and Symphony are trademarks of Lotus Development Corp., IBM Personal Computer AT is a trademark of International Business Machines, Inc. Quadboard, QuadMaster and the Quadram logo are registered trademarks of Quadram Corp. Windows is a registered trademark of Microsoft, Inc. AST Advantage is a registered trademark of AST.

SPF EDITORS

intended primarily for a technical environment, word processors are best suited for the business setting.

The third category, text (program) editors, falls between the other two. While these products offer text processing functions and lend themselves to word processing more so than line editors, they are best suited to the production of structured program code. These three categories are not hard and fast, and some products straddle the boundaries, as was illustrated in a previous review, "18 Program Editors," (Susan Glinert-Cole, *PC Tech Journal*, September/October 1983, p. 110).

The four products reviewed in this article are program editors modeled on the ISPF mainframe full-screen editor, which is part of IBM's Interactive System Productivity Facility/Program Development Facility (ISPF/PDF). Therefore, these four implementations of ISPF are, appropriately, compared to the actual mainframe product in each area.

For programmers accustomed to the power of the ISPF full-screen editor, or to any other mainframe full-screen editor, using a line editor to write programs for personal computers is frustrating. Most users would welcome the power and convenience of an ISPF emulation for the PC. The potential for enhancement of productivity in developing stand-alone programs for personal computers is great. Word-processing programs provide full-screen capabilities in editing programs, but their functions are not necessarily tailored to the needs of program development.

Another consideration is the programmer workstation. Although this development, long prophesied, has been slow in coming, program editors of this type would be valuable where stand-alone or distributed program development is desired. Mainframe TSO files can be downloaded to the PC, or uploaded, with considerable ease, thanks to the development of reliable emulation products. (See "Emulating the 3278," Roger Addelson, *PC Tech Journal*, February 1986, p.66). Communications software can transfer files produced by the four products reviewed here between PC and mainframe TSO environments. The necessary conversion between ASCII and EBCDIC can be automatic during such transfers.

To carry this development one step further in the direction of distributed development, off-line compiles on a minicomputer or on the PC itself would be desirable as well. Although an account of them lies outside the scope of this review, products now on the mar-

TABLE 1: Function and Control Key Defaults

	APS/SPF	HCS ED.	MIC/SPF	SPF/PC	ISPF
F1	Help	Rfrsh/Hom	Help	Help	(PF1)HELP
F2	End	Split	Split	Split	(PF2)SPLIT
F3	Find	End/Save	End	End	(PF3)END
F4	Change	PrtSc	Return	Swap	(PF4)RETRN
F5	Return	Rfind	Rfind	Find	(PF5)RFIND
F6	Swap	Rchng	Rchng	Change	(PF6)RCHG
F7	Up	Up	Left	Up	(PF7)UP
F8	Down	Down	Right	Down	(PF8)DOWN
F9	Left	Swap	Swap	Left	(PF9)SWAP
F10	Right	Left	DOS	Right	(PF10)LEFT
Shift-F1	Help	Right	Undef.	Help	(PF11)RGHT
Shift-F2	End	Home	Undef.	Split	(PF12)CSR
Ins	Ins	Ins	Ins	Ins	INS
Del	Del	Del	Del	Del	DEL
Left arrow	Left cur.	Left cur.	Left cur.	Left cur.	LEFT CURS
Right arrow	Rt. cur.	Rt. cur.	Rt. cur.	Rt. cur.	RT CURSOR
Up arrow	Up cur.	Up cur.	Up cur.	Up cur.	UP CURSOR
Down arrow	Down cur.	Down cur.	Down cur.	Down cur.	DN CURS
PgUp	PgUp	Undef.	PgUp	PgUp	N/a
PgDn	PgDn	Undef.	PgDn	PgDn	N/a
Home	Home/Scrl	Undef.	Home	Home	HOME
Shift-PrtSc	PrtSc	PrtSc	PrtSc	PrtSc	N/a
Ctrl-M	Downline	Enter	Undef.	Enter	N/a
Ctrl-PrtSc	Undef.	Undef.	Undef.	PrtSc	N/a
Enter	N/a	N/a	Downline	Downline	Downline
Highlight line no.	No	No	Yes	No	Yes
Plus (+)	Downline	+	Enter	Enter	N/a
Plus (+) custom.	Yes	No	No	Yes	N/a
Tab into line number field	No	Yes	Yes	Yes	Yes

The differences in key mappings of various functions among the four products reviewed is puzzling, given the clean standard available in mainframe ISPF.

ket allow for development, compilation, and even test execution of programs in COBOL, permitting an upload to the mainframe of clean, executable programs. Some products promise that even command level CICS can be developed on the micro-computer (see "Personal CICS," Brandy C. De Shazo, *PC Tech Journal*, December 1985, p. 171).

PC-based ISPF-type editors thus have two markets: the mainframe/distributed workstation arena and the stand-alone micro environment. The following section offers an explanation of conventional mainframe ISPF edit functions, a summary of the basis for review and comparison.

FORMIDABLE ISPF

IBM mainframe ISPF is more than simply a text editor. It is a wholly menu-driven program development facility. It includes features that provide follow-up support for programs edited in ISPF, such as on-line compiles and execution of programs, submission of batch jobs,

inspection of batch job queues, routing and browsing program output and listings, ISPF edit macros, executable command lists (CLISTS) to perform various foreground TSO command functions, and Dialog Manager functions permitting design and execution of user-written screens. Mainframe ISPF also allows for customized main menus (generally by systems programmers) to provide access to locally written functions. This section will focus on the edit functions of the product.

In addition to IBM's usual thorough documentation, ISPF includes a built-in segmented tutorial, which can be taken sequentially as a training package, or selectively via menu.

Function keys and scrolling. Mainframe 3270 terminals provide programmable function (PF) keys, like PC function (F) keys, to facilitate command execution with a single keystroke. The assignment of functions to the PF keys is menu modifiable. Table 1 lists PC function and control keys and the equivalent

WHAT'S A GIGABYTE?

Suppose you color-in each small square on this page. There are 10,000 squares. That's the Good News. . .

The Bad News is you have 100,000 more pages to go.

Now suppose each square represents a BYTE of data. You will have colored an entire

Gigabyte!

Imagine your PC working with file sizes to 1,000MB under DOS. The GIGAfile™ File-Stretcher by CORE satisfies today's storage needs and ensures future capacity.

GIGAfile™ comes with every CORE hard disk in excess of 32MB capacity so you don't have to partition the drive into logical volumes. Unless you want to.

The DOS limitation of 32MB file size is no longer a barrier with GIGAfile™ and the higher capacity mass storage devices from CORE International.

You can have files and/or directories as big as a full gigabyte.

On files this big you could maintain a nearly unlimited customer-lead file with hundreds of thousands of names and addresses for a successful direct mail campaign. Physicians and Attorneys can now have detailed patient and client files electronically stored, thus relieving pressure on hard-copy file space.

Since no single PC hard disk yet can store a Gigabyte, GIGAfile™ makes it possible to have your files expand across as many as eight physical storage devices. For example, you can install two CORE 72MB High Performance hard disks in an IBM PC-AT or compatible and have one huge 144 MB file resident! Your system will see both drives as one device. And the CORE Drives support large files under XENIX™ too.

And as CORE's near-future mass-storage development yields even higher capacity devices, you'll be ensuring your capability for future storage growth. The time is rapidly approaching when multi megabyte spreadsheets and 100MB, 300MB or even larger databases will be common.

Some even as big as a Gigabyte. And that's like 100,000 pages of grids like the one above, each with 10,000 squares, to give you an idea of just how big a "Gig" really is. One Billion Bytes. 1,000 Megabytes. 1,000,000,000 characters of information. GIGAfile™.

So call us now. Learn more about how GIGAfile™ can help you avoid hardware obsolescence, take care of today's storage needs and ensure future capacity. Remember, you can only get GIGAfile™ with the 40, 56, and 72MB high-performance drives from CORE. So why wait? You have nothing to lose, and everything to save. *Everything.*

CIRCLE NO. 179 ON READER SERVICE CARD

 **CORE**
INTERNATIONAL

7171 North Federal Highway □ Boca Raton, Florida 33431 □ 305/997-6055

© 1986 CORE International Inc. XENIX is a trademark of Microsoft, Inc. Crayola® is a registered trademark of Binney & Smith, Inc. GIGAfile is a trademark of CORE International, Inc.

SPF EDITORS

mainframe ISPF keys, with the default key mappings between the two for the four PC-based SPF editors reviewed.

Mainframe ISPF HELP is context-sensitive, and invokes the portion of the tutorial relevant to the functions being used. However, a submenu usually is offered permitting the user to choose related tutorial sections as well.

Two ISPF functions can be employed at once using the SPLIT SCREEN function. In the middle of an edit session, this function key can split the screen at the line occupied by the cursor, so that another file can be edited or one of the other ISPF functions invoked without terminating the first edit session or current ISPF function. Only one of these two sessions can be active at any time, however. The position of the cursor determines which of the two split-screen sessions will be active next. The user can move the cursor between the two sessions. If most of the screen is occupied by one session, invoking Swap will cause the session occupying less of the display to occupy the larger segment; the cursor will move to the other session, making it the active session while the first becomes inactive, but not terminated.

Both horizontal and vertical scrolling are available via function key.

TABLE 2: Scrolling Commands

	APS/SPF	HCS ED.	MIC./SPF	SPF/PC	ISPF
INTEGER	Yes	Yes	Yes	Yes	Yes
PAGE	Yes	Yes	Yes	Yes	Yes
HALF	Yes	Yes	Yes	Yes	Yes
MAX ^a	Yes	Yes	Yes	Yes	Yes
CURSOR	Yes	Yes	Yes	Yes	Yes
TOP	No	Yes	No	No	No
BOT	No	Yes	No	No	No

^aIn command line.

HCS Editor's TOP and BOT commands are enhancements to the ISPF standards that move the cursor to the beginning or end, respectively, of data.

Parameters that will determine the extent of the scroll are entered at the top of the screen in a field reserved for this purpose (see table 2 for a list of available commands). Supported parameters include scrolling a full page of data or half a page, as well as scrolling the line currently occupied by the cursor to the top or bottom of the screen. An integer value results in the screen's scrolling by that number of lines or columns. The TOP and BOT commands are not supported by mainframe ISPF, but entering MAX causes the screen to scroll to the limits of the data in any of the four directions.

The RETURN function takes the screen to the main ISPF menu, unless HELP has been invoked from another function, in which case the screen returns to the function from which HELP was called. From a submenu, END will take the screen to the next menu up in the menu hierarchy. From an edit session, END will terminate the session and save the data, and from the main menu, END will terminate the ISPF session. If the screen is split, END will terminate the active session and return control to the inactive session.

When the FIND or CHANGE commands (described below in detail) are

THE BEST PC TEXT EDITOR JUST GOT BETTER.

ANNOUNCING SPF/PC™ 1.82

The best full screen editor for the IBM PC now extends support for large files to all PC's, not just the IBM/AT. Invoke your favorite program/compiler from within Edit at any time regardless of file size. CTC's SPF/PC™ 1.82 still looks like its mainframe cousin but executes faster with more options.

NEW FEATURES

- **PAGING** - Editing limited only by capacity of expanded/extended memory or hard disk.
- **SPEED** - Search 1,500,000 byte file with IBM AT in less than 13 seconds. By comparison, the IBM 3081 mainframe takes 48 seconds.

\$195
UPGRADES only \$50
ADD \$6 shipping
Canada \$10, Foreign \$15
 
Payment in U.S. funds by check or bank wire (Bank of America, San Francisco account 05583-05454). Net 30 to D&B rated firms.

- Compatible with IBM and Novell Networks
- Modifiable HEX display
- Line length to 954 bytes

Minimum Requirements:
DOS 2.00-3.10, 192KB memory,
any IBM PC or true compatible
or TI Professional.



Command Technology Corporation
1900 Mountain Boulevard
Oakland, California 94611

TO ORDER Telephone: (415) 339-3530
SPF/PC..... Telex: 509330 COMMAND TECH

CIRCLE NO. 227 ON READER SERVICE CARD

DeSmet

C

**8086/8088
Development
Package**

\$109

FULL DEVELOPMENT PACKAGE

- Full K&R C Compiler
- Assembler, Linker & Librarian
- Full-Screen Editor
- Execution Profiler
- Complete **STDIO** Library (>120 Func)

Automatic DOS 1.X/2.X SUPPORT

**BOTH 8087 AND S/W FLOATING POINT
OVERLAYS**

OUTSTANDING PERFORMANCE

- First and Second in AUG '83 BYTE benchmarks

SYMBOLIC DEBUGGER

\$50

- Examine & change variables by name using C expressions
- Flip between debug and display screen
- Display C source during execution
- Set multiple breakpoints by function or line number

DOS LINK SUPPORT

\$35

- Uses DOS .OBJ Format
- LINKs with DOS ASM
- Uses Lattice® naming conventions

Check: Dev. Pkg (109)

Debugger (50)

DOS Link Supt (35)

SHIP TO: _____

ZIP _____

CWARE
CORPORATION

P.O. BOX C
Sunnyvale, CA 94087
(408) 720-9696

All orders shipped UPS surface on IBM format disks. Shipping included in price. California residents add sales tax. Canada shipping add \$5, elsewhere add \$15. Checks must be on US Bank and in US Dollars. Call 9 a.m. - 1 p.m. to CHARGE by VISA/MC/AMEX.

SPF EDITORS

TABLE 3: Edit and Browse Primary Commands

	APS/SPF	HCS ED.	MIC./SPF	SPF/PC	ISPF
EDIT PRIMARY COMMANDS					
LOCATE	Yes	Yes ^a	Yes	Yes	Yes
LOCATE 0 = top line	No	Yes	Yes	Yes	Yes
NUMBER	No	Yes	Yes	Yes	Yes
Supplies COBOL line numbers	No	No	Yes	Yes	Yes
.COB turns NUM on COB	No	No	No	Yes	Yes
RENUM	Yes	Yes	Yes	Yes	Yes
UNNUM	No	Yes	Yes	Yes	Yes
AUTONUM	No	No	Yes	Yes	Yes
AUTOSAVE	No	Yes	No	No	No
STATS	No	No	Yes	Yes	Yes
PRINT	No	No	Yes	Yes	Yes
RECOVERY	No	No	No	No	Yes
RESET	Yes	Yes	Yes	Yes	Yes
SUBMIT	No	No	No	No	Yes
SAVE	Yes	Yes	Yes	Yes	Yes
CANCEL	Yes	Yes	Yes	Yes	Yes
FIND	Yes	Yes	Yes	Yes	Yes
Cur. at begin of string	Yes	No ^b	Yes	Yes	Yes
Highlight line number	Yes	No	Yes	Yes	Yes
CHANGE	Yes	Yes	Yes	Yes	Yes
COPY	Yes	Yes	Yes	Yes	Yes
MOVE	Yes	No	Yes	Yes	Yes
NULLS	No	No	No	No	Yes
Default, allow insert	Yes	Yes	Yes	Yes	N/a
CREATE	Yes	Yes	Yes	Yes	Yes
REPLACE	Yes	Yes	Yes	Yes	Yes
TABS	No	No	Yes	Yes	Yes
PROFILE	Yes	No	Yes	Yes	Yes
Data type	Yes	N/a	Yes	Yes	Yes
Recovery	Sim.	N/a	No	No	Yes
Number	Yes	N/a	Yes	Yes	Yes
Caps	Yes	N/a	Yes	Yes	Yes
Hex	Yes	N/a	Yes	Yes	Yes
Nulls	Sim.	N/a	No	No	Yes
Tabs	Yes	N/a	Yes	Yes	Yes

in use, the RFIND (repeat find) or RCHANGE (repeat change) function repeats the last find or change command on the target string.

Primary commands. ISPF supports two kinds of commands: primary and line. Primary commands are entered in the command field, which normally is displayed at the top of the screen, but can be customized and made to appear at the bottom. (These commands are listed in table 3.) Line commands are entered adjacent to a particular line of data, in the generated line number field in the left margin of the screen.

A particular line can be brought up by entering the LOCATE primary command, followed by a line number. Sequential line numbers in the left margin support this command. These numbers

are not the same as numbers that are an integral part of the data or the program—for example, COBOL program line numbers. Such program line numbers can be created by the NUMBER command, deleted by the UNNUMBER command, or renumbered by the RENUMBER command. The AUTONUM command causes the file to be renumbered automatically when it is saved.

Hexadecimal displays of data can be viewed by invoking the HEX command, which can be toggled on and off with parameters ON and OFF. The hexadecimal representation of the characters on the screen is displayed in two lines below each line of characters. Two formats are available: DATA displays a hexadecimal string wrapped to the second line, including trailing blanks. VERT

	APS/SPF	HCS ED.	MIC./SPF	SPF/PC	ISPF
Autosave	No	N/a	No	No	Yes
Autonum	Yes	N/a	Yes	Yes	Yes
Autolist	No	N/a	No	Sim.	Yes
Autobak	Sim.	N/a	No	No	No
Stats	Yes	N/a	Yes	Yes	Yes
Profile (lock/unlock)	No	N/a	No	No	Yes
Imacro	No	N/a	No	No	Yes
Pack	No	N/a	Yes	No	Yes
Note	No	N/a	No	No	Yes
HEX	Yes	Yes	Yes	Yes	Yes
ON	Yes	Tog.	Yes	Yes	Yes
OFF	Yes	No	Yes	Yes	Yes
VERT	Yes	Yes	Yes	Yes	Yes
DATA	No	No	Yes	No	Yes
EBCDIC	Yes	No	Yes	Yes	Yes
Based on ASCII chars.	No	N/a	Yes	Yes	N/a
Based on hex display	Yes	N/a	No	No	N/a
ASCII	Yes	No	Yes	Yes	No
ASCII modifiable	Yes	Yes	Yes	Yes	Yes
EBCDIC modifiable	Yes	N/a	No	Yes	N/a
Modifications effective immediately	Yes	Yes	No	No	No
After pressing Enter	Yes	Yes	Yes	Yes	Yes
CAPS ON/OFF	Yes	Yes	Yes	Yes	Yes
EDIT (recurs., cmd line)	No	No	No	No	Yes
CHECK for invalid ASCII	No	No	No	Yes	No
TRANSFER	No	No	No	Yes	No
AUTOBAK	Yes	No	No	No	No
BROWSE PRIMARY COMMANDS					
LOCATE	Yes	Yes ^a	Yes	Yes	Yes
FIND	Yes	Yes	Yes	Yes	Yes
COLS	No	Yes	Yes	Yes	Yes
CAPS	Yes	Yes	Yes	Yes	Yes
RESET	Yes	Yes	Yes	Yes	Yes
HEX full features	Yes	Tog.	Yes	Yes	Yes
Sim.=simulated	Tog.=toggle	^a LIN	^b End plus one.		

"Simulated" means that, while displayed on the screen, the indicated toggle is not actually implemented in the editor's software and it conveys no real information.

displays two hexadecimal numbers vertically below each respective character. The hexadecimal numbers can be altered, and when the Enter key is pressed, any changes made to the hexadecimal numbers also are made to the corresponding character.

Two aids to editing are provided: TABS and NULLS. TABS is a primary command that brings up a tab edit line for setting or changing tab positions in the document. When NULLS is ON, lines are padded with null characters, permitting easy insertion of characters within the line. When NULLS is OFF, each line is padded with trailing blanks. If insertion is necessary, something must be deleted for each insertion, for example, deleting the trailing blanks using EOF (erase to end of field).

The file being edited in storage can be saved as a disk file using the SAVE command. Ending the edit session automatically results in such an operation. The CANcel command exits an edit session without updating the original disk file. The COPY command reads another disk file and inserts it into the file currently being edited. Similarly, the MOVE command reads a file, inserts it into the current file, and deletes the MOVED file from disk. Part or all of the current file can be used to CREATE a new file or to REPLACE an existing one.

To accommodate documents in mixed case (mainframe programs are in uppercase), the primary command CAPS is provided. CAPS can be turned ON to permit keying in lowercase with automatic conversion to uppercase when



Number One In Performance

Hard Disk Intelligent VCR Backup for AT/XT/PC

FEATURES

- High speed microprocessor controlled backup (68000)
- Two channel interface
- Built in LAN channel
- Software control of most VCR functions including Fast Forward, Rewind, and auto backup using VCR timer capabilities
- Economical VHS or Beta formats



West: 4704 W. Jennifer, Suite 105, Fresno, CA 93711, 209/276-2345
East: 67 Grandview, Pleasantville, NY 10570, 914/747-1450
Distributor: Telemarketing Services, Inc.
1897 Garden Ave., Eugene, OR 97403, 503/345-7395

CIRCLE NO. 237 ON READER SERVICE CARD

MS-DOS, UNIX, APPLE MAC, CP/M, NETWORKS and MORE. ONE c-tree ISAM DOES THEM ALL!

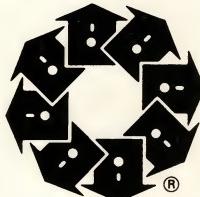
The creator of Access Manager™ brings you the most powerful C source code, B+ Tree file handler: **c-tree™**

- multi-key ISAM and low-level B+ Tree routines
- complete C source code written to K&R standards
- single-user, network and multi-tasking capabilities
- fixed and variable record length data files
- virtually opened files accommodate limited file descriptors
- no royalties on application programs

\$395 COMPLETE

Specify diskette format:

- 5 1/4" MS-DOS
- 8" CP/M
- 3 1/2" Mac
- 8" RT-II



For VISA, MC and COD orders

call (314) 445-6833

FairCom

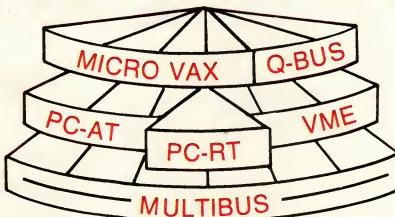
2606 Johnson Drive
Columbia, MO 65203

© 1985 FairCom

The following are trademarks: c-tree and the circular disk logo—FairCom; MS—Microsoft Inc.; CP/M and Access Manager—Digital Research Inc.; Unix—AT&T; Apple—Apple Computer Co.

CIRCLE NO. 119 ON READER SERVICE CARD

SMD/SCSI And More For . . .



COMPLETE, COMPATIBLE, SMD DISK/TAPE MEMORY SYSTEMS WITH . . .

SMD/SCSI or Pertec, and 8 inch Winchester technology intelligently adapted to meet your needs in **leading system environments**.

Data rates up to 2.4 MB/SEC, access times of 15ms-20ms.

Disk storage/systems of 84MB, 168MB, 335MB, 474MB, 689MB, and up. Compatible with major networks **designed for performance**.

Industry standard nine-track 1/2 inch, and 1/4 inch **tape back up** systems.

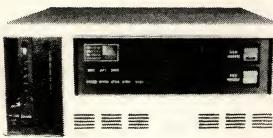
Multifunction single board controller for PC-AT, PC-RT, Unibus, and Q-Bus.

Tower, desk top **rack mount** configurations are optional.

Laser optical disk technology and systems too!



SMD/SCSI multifunction
for PC-AT/RT



Desk Top/Rack Mount
Disk/Tape Systems

TWX 9103866006
TELEX 821892 NMS UD
LIVERMORE, CA 94550

National
Memory
Systems
CORPORATION

415-443-1669

---WE ARE HERE FOR YOU---

CIRCLE NO. 161 ON READER SERVICE CARD

SPF EDITORS

Enter is pressed. When CAPS is turned OFF, data entry is in ASIS mode, with upper- and lowercase distinctions preserved in the data entered.

If recovery mode is on, the user is protected by *checkpointing*, which is a form of audit trail for edit changes. Change commands are saved in a temporary file that may be rerun if the edit session is somehow interrupted by a system problem: all changes that were made but not saved to the edit file before the interruption took place may be redone automatically.

The RESET command eliminates any messages, profile displays, and flags or highlights in the line number field, such as those that are created by the line commands described below.

A recent enhancement to ISPF allows the primary command EDIT to be entered recursively in the command line to start new edit sessions again and again, in addition to the two sessions available in split screen mode. Each time a new session is initiated, the prior session is suspended. The END command terminates the current session and returns to the session from which the current session was called. This process can be repeated until all of the suspended sessions have been reentered and terminated.

Find and change primary commands. The heart of the ISPF editor is its ability to find and change specified strings. The primary command FIND sets the cursor on the first character of the target string, highlights the line number containing the cursor, and displays a new screen full of data (if this is necessary to display the line containing the first occurrence of the target string). The FIND parameters are exceptionally numerous and powerful (see table 4). If a target string occurs more than once in the file, ALL positions the cursor on the first occurrence of the string and provides a count of the total number of occurrences. NEXT (the default) displays the next occurrence of the string, while PREV shows the occurrence previous to the current position of the cursor. LAST displays the last occurrence of the string in the file.

The FIND command is followed on the command line by a specification of the target string. The default condition, designated by CHARS, locates the first occurrence of a string of characters regardless of its position within a word. If the target string is bounded by spaces or a line, then the parameter WORD should be used. If the string is preceded by a space or a line boundary, then the PREFIX parameter is used; if

TABLE 4: Find and Change Parameters

	APS/SPF	HCS ED.	MIC./SPF	SPF/PC	ISPF
NEXT	No	No	Yes	Yes	Yes
ALL	Yes	Yes	Yes	Yes	Yes
FIRST	No	Yes	Yes	Yes	Yes
LAST	No	Yes	Yes	Yes	Yes
PREV	No	Yes	Yes	No	Yes
CHARS	No	No	Yes	Yes	Yes
PREFIX	No	No	Yes	Yes	Yes
SUFFIX	No	No	Yes	Yes	Yes
WORD	No	No	Yes	Yes	Yes
Picture Strings	Yes	No	Yes	No	Yes
P '=' any character	Yes	N/a	Yes	N/a	Yes
P 'T' nonblank	Yes ^a	N/a	Yes ^b	N/a	Yes
P '.' nondisplayable	Yes	N/a	Yes	N/a	Yes
P '#' numeric (0-9)	Yes	N/a	Yes	N/a	Yes
P '-' non-numeric	Yes	N/a	Yes	N/a	Yes
P '@' alpha. (uc./lc.)	Yes	N/a	Yes	N/a	Yes
P '<' lowercase alpha.	Yes	N/a	Yes	N/a	Yes
P '>' uppercase alpha.	Yes	N/a	Yes	N/a	Yes
P '\$' special ^c	Yes	N/a	Yes	N/a	Yes
HEX	Yes	Yes	Yes	No	Yes
X/NX	Yes	No	Yes	Yes	Yes
COL1, COL2	Yes	Yes	Yes	Yes	Yes
T (FIND T 'string')	Yes	No	Yes	No	Yes
* (previous value)	Yes	Yes	Yes	Yes	Yes
<i>^aCaret used: P'^'</i>	<i>^bTilde used: P'''</i>	<i>^cNot alphabetic, not numeric.</i>			

Micro/SPF provides the most complete set of find and change features, emulating mainframe ISPF in nearly all respects; it includes the very useful FIND P.'.

the string is followed by blanks or the end of a line, then SUFFIX is used.

Whether or not CAPS is on, the target string will be located only if some string matches the search string exactly, including upper- and lowercase differences. If the user wishes to disregard upper/lowercase differences both in the file being edited and in the specification of the target string, the T parameter is used by entering FIND T'string'. This parameter can be combined with any of the others described above.

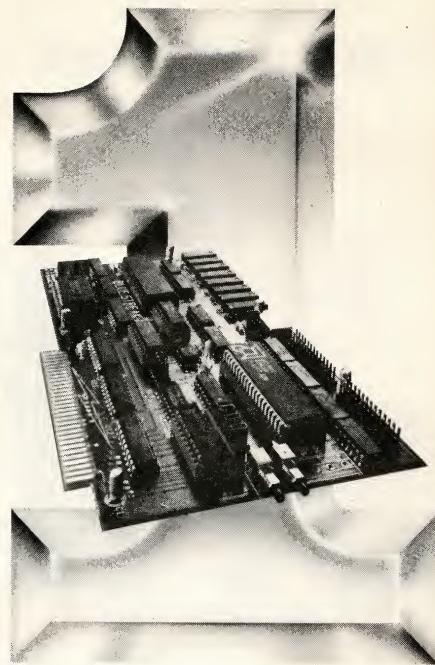
The target can be specified in other ways. A hexadecimal string can be specified by entering FIND X'nn', where n is a string of hexadecimal numbers in the file. Even more powerful is the picture specification—in the format FIND P'x—where x is a character representing a data type. Table 4 includes picture string specifications, which allow locating, counting, or changing alphabetic, uppercase only, lowercase only, numeric, special, and other character occurrences. A particularly useful parameter is FIND P'.', which locates invalid (nondisplay) characters present in a file. When a file containing such characters is edited, the first display of the data comes up with a warning message to this effect, advising the user to

invoke the FIND P.' command to locate these characters.

Still other parameters can be specified. When the FIND command is followed by two integers, the search is restricted to the columns beginning and ending with these numbers. If lines have been excluded from the display by means of the exclude line command (described below), the search can be restricted to only the excluded lines using the X parameter, or to only the lines not excluded using NX.

Finally, the FIND command remembers the last string specification used: FIND * searches for the string specified for the last FIND command. The repeat find function is thus equivalent to FIND * NEXT, for finding the next occurrence of the target string.

All the special features supported for FIND can be used with the CHANGE primary command. The character, hexadecimal, and picture specifications can be used to express both the target string and the string with which the target is to be replaced. In a file containing multiple occurrences of the target, ALL changes all occurrences of the string at once; repeating the CHANGE command lets the user review all changes before they are made.



Number One in Performance

Z80H
BLUE STREAK™

IBM/AT/XT/PC- 8mz
No Wait States

FEATURES

- 64K-256K RAM
- 2K-8K EPROM/Static Ram
- 2 Serial Ports
- Async/Sync/Bisync Communications
- Real Time Clock
- Memory-mapped Dual-port BUS
- On-board/Remote Reset NMI capability
- Up To 32 Boards Per AT/XT/PC
- Can Operate As Standalone Processor
- Less Than Full Size Board
- (will fit other compatibles.)

SOFTWARE

- ZP/M tm CP/M Emulation Software
- (Supports Most CP/M Software)
- Multiuser Capability If Used As A Slave Processor

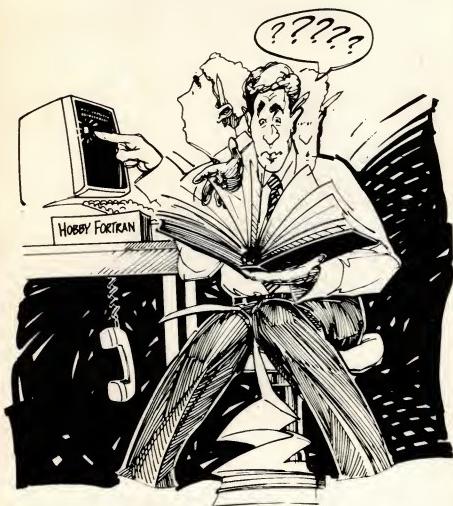
IBM is a registered trademark of International Business Machines.
CP/M is a registered trademark of Digital Research Corp.



West: 4704 W. Jennifer, Suite 105, Fresno, CA 93711, 209/276-2345
East: 67 Grandview, Pleasantville, NY 10570, 914/747-1450
Distributor: Telemarketing Services, Inc.
1897 Garden Ave., Eugene, OR 97403, 503/345-7395

CIRCLE NO. 236 ON READER SERVICE CARD

FORTRAN PROGRAMMERS



CONFUSED BY YOUR FORTRAN'S ONSCREEN DIAGNOSTICS?

F77L, our complete FORTRAN 77 Language System for the PC, eliminates the confusion by explicitly diagnosing errors. The compiler and run-time messages describe, in plain English, the nature and location of the error. For logical program errors, we provide our unique Source On-Line Debugger (SOLD). SOLD allows you to interface with your program at the FORTRAN level and does not require re-compiling or re-linking. If you happen to run into an especially tough problem, you can always call our technical staff for assistance.

**PHONE FOR DETAILS about
VERSION 2.00 and our NEW MANUAL**

F77L
"THE PROGRAMMER'S FORTRAN"
\$477.00

Requires: PC/MS-DOS, 256K, 8087

TO ORDER OR FOR MORE INFORMATION

(213) 541-1200



Lahey Computer Systems, Inc.
31244 Palos Verdes Drive West
Suite #243
Rancho Palos Verdes, CA 90274

Serving the FORTRAN community since 1969
NUMBER THREE IN A SERIES OF THREE

SPF EDITORS

TABLE 5: Line Commands

	APS/SPF	HCS ED.	MIC./SPF	SPF/PC	ISPF
COLS	Yes	No	Yes	Yes	Yes
I(nsert)	Yes	Yes	Yes	Yes	Yes
In	Yes	Yes	Yes	Yes	Yes
D(elete)	Yes	Yes	Yes	Yes	Yes
Dn	Yes	Yes	Yes	Yes	Yes
DD	Yes	Yes	Yes	Yes	Yes
R(epet)	Yes	Yes	Yes	Yes	Yes
Rn	Yes	Yes	Yes	Yes	Yes
RR	Yes	Yes	Yes	Yes	Yes
RRn	Yes	No	Yes	Yes	Yes
M(ove)	Yes	Yes	Yes	Yes	Yes
Mn	Yes	Yes	Yes	Yes	Yes
MM	Yes	Yes	Yes	Yes	Yes
C(opy)	Yes	Yes	Yes	Yes	Yes
Cn	Yes	Yes	Yes	Yes	Yes
CC	Yes	Yes	Yes	Yes	Yes
A(fter)	Yes	Yes	Yes	Yes	Yes
An	No	No	Yes	No	Yes
B(efore)	Yes	Yes	Yes	Yes	Yes
Bn	No	No	Yes	No	Yes
MASK	No	No	Yes	Yes	Yes
<	Yes	Yes	Yes	Yes	Yes
<n	Yes	Yes	Yes	Yes	Yes
<<	Yes	Yes	Yes	Yes	Yes
<<n	Yes	Yes	Yes	Yes	Yes
>	Yes	Yes	Yes	Yes	Yes
>n	Yes	Yes	Yes	Yes	Yes
>>	Yes	Yes	Yes	Yes	Yes
>>n	Yes	Yes	Yes	Yes	Yes
(	Yes	No	Yes	Yes	Yes
(n	Yes	No	Yes	Yes	Yes
((	Yes	No	Yes	Yes	Yes
((n	Yes	No	Yes	Yes	Yes
)	Yes	No	Yes	Yes	Yes
)n	Yes	No	Yes	Yes	Yes
))	Yes	No	Yes	Yes	Yes
))n	Yes	No	Yes	Yes	Yes
BOUNDS	Yes	Yes	Yes	Yes	Yes
(e)X(clude)	Yes	Yes	Yes	Yes	Yes
Xn	Yes	Yes	Yes	Yes	Yes
XX	Yes	Yes	Yes	Yes	Yes
S(how)	Yes	No	Yes	Yes	Yes

Edit profiles. The PROFILE command produces a display that uses up to the first seven lines of the screen. The first data line begins below the profile display. ISPF allows each user to define as many as 25 different edit profiles. Each profile specifies a data type, such as DATA, COBOL, PLI, and so on. By making the lowest-level qualifier in the data set name equivalent to the name of one of these profiles, the user can cause ISPF to tailor the handling of the file automatically to the type of data that it contains. Such features as the numbering of COBOL program lines and, conversely, the suppression of explicit line

numbers in documentation files can be preset in this way. (These profile parameters are listed in table 3.)

The user also can specify tab settings; whether the data are to be stored in packed (compressed) format; whether any edit macros are to be used; and whether statistics (STATS), such as the version and modification or the date last modified, are to be kept and updated on the file. Besides signaling the status of various toggled parameters, such as CAPS (ON/OFF) and NUMBER (ON/OFF), the profile display can display the current contents of the TABS, BOUNDS, and MASK lines (the

	APS/SPF	HCS ED.	MIC./SPF	SPF/PC	ISPF
Sn	Yes	No	Yes	Yes	Yes
F(irst)	Yes	Yes	Yes	Yes	Yes
Fn	Yes	Yes	Yes	Yes	Yes
L(ast)	Yes	Yes	Yes	Yes	Yes
Ln	Yes	Yes	Yes	Yes	Yes
TABS	Yes	No	Yes	Yes	Yes
TE	Yes	Yes ^a	No	Yes	Yes
Like mainframe TE	No	No	N/a	No	N/a
TEn	No	No	No	No	Yes
TS	Yes	No	Yes	Yes	Yes
TSn = no. of lines ins.	No	No	Yes	Yes	Yes
TF	Yes	Yes ^b	No	Yes	Yes
TFn (left bnd to ncol)	Yes	Yes ^b	No	Yes	Yes
TJ	Yes	No	No	No	No
TJn	Yes	No	No	No	No
O(overlay) (receiv. lines)	Yes	Yes	Yes	Yes	Yes
On	Yes	Yes	Yes	Yes	Yes
OO	Yes	Yes	Yes	Yes	Yes
K	No	Yes	No	No	No
Kn	No	Yes	No	No	No
KK	No	Yes	No	No	No
E (exchange lines)	No	Yes	No	No	No
Perf. cmd's. on excl. line	Yes	Yes	Yes	Yes	Yes

If line command entry error made (invalid cmd.), can correct with:

Delete	No	Yes	Yes	Yes
Overtype with commandS	Yes	Yes	N/n	Yes
Overtype with number	No	No	Yes	N/n
Overtype with blank	No	Yes	Yes	N/n
Hit Enter twice	No	No	No	Yes
Reset	Yes	Yes	Yes	N/n

If line command entry error made (valid cmd.), can correct with:

Delete	No	No	Yes	Yes
Overtype with commandNo	Yes	Yes	No	Yes
Overtype with number	No	No	Yes	No
Overtype with blank	Yes	Yes	Yes	Yes
Hit Enter twice	No	No	No	Yes
Reset	Yes	Yes	Yes	Yes

^aTEX ^bT N/n = Not needed S = Sometimes

Micro/SPF's implementation of mainframe ISPF line commands is the cleanest and the most complete of all products reviewed, offering a most reliable emulation.

information that appears in these function lines is explained below).

Line commands. In addition to the primary commands that are entered on the command line, ISPF provides commands that are entered by positioning the cursor in the generated line number field in the left-most columns of the screen display. These commands are summarized above in table 5.

The COLS command creates a display on the line where the cursor was positioned, moving the data originally shown on that line down one line. This display provides column numbers to aid in interpreting fields in data being

edited, checking column positions of structured code, and so on.

A similar display is created by BOUNDS, which shows the beginning and end of bounds for data entry, and within which text is flowed, for example, by the text flow command. Text flow in mainframe ISPF is similar to paragraph reformat in WordStar: text that has been entered "out of bounds" is automatically rearranged so that all of it falls outside the current bounds for text in that part of the edit document.

Another such line display is created by the TABS line command, for specification of tabs. The tabs that are cur-



Number One in Performance

68010/68000

Coprocessor for IBM/AT/XT/PC-

8/10/12.5mz No Wait States

\$1295⁰⁰ Qty. 1

FEATURES

- 1-2 MB RAM (1MB Standard)
- 16K-64K EPROM
- 2-8 Serial Ports
- Async/Sync/Bisync Communications
- Battery-backed Real Time Clock
- Battery-backed 2K-8K RAM
- 2 Parallel Ports
- 68881 Math Coprocessor
- Memory-mapped Dual-port BUS
- 3-9 Users Per Board (3 Standard)
- Up To 16 Boards Per AT/XT/PC
- Can Operate As Standalone Processor

SOFTWARE

- OS9 (Powerful UNIX-like Multi-user OS)
- CPM/68K
- Software selectable OS including concurrent PC DOS/OS-9 or CPM/68K operation
- Support Module for IBM Graphics
- High-speed Local/Global Disk Caching
- Basic, Pascal, Fortran, C, and COBOL

IBM is a registered trademark of International Business Machines. CPM-9 is a registered trademark of Microware Systems Corp. CPM-8K is a registered trademark of Digital Research Corp. M68000 and M68010 are registered trademarks of Motorola. UNIX is a registered trademark of AT&T.



West: 4704 W. Jennifer, Suite 105, Fresno, CA 93711, 209/276-2345
East: 67 Grandview, Pleasantville, NY 10570, 914/747-1450
Distributor: Telemarketing Services, Inc.
1897 Garden Ave., Eugene, OR 97403, 503/345-7395

CIRCLE NO. 238 ON READER SERVICE CARD

SPF EDITORS

rently in use are displayed initially, and can be altered and saved.

The MASK command edits the previously saved mask or generates a new one if none has been saved. A mask is simply a text line given some original character pattern. When the command to insert lines is invoked, the mask will be copied into the inserted lines. Its most common use is to preinitialize comment lines with such characters as C, /*, or */ so that the user does not need to type comment delimiters each time a comment line is inserted.

Most other line commands are basically one character and have three formats: L, Ln, and LL. The command alone affects just one line; if followed by an integer, the command is applied to that number of lines. If the two-letter line command (LL, above) is typed on two separate lines, the lines between the commands become a block of lines to be processed in some way. The integer *n* can be appended to the first, last, or both occurrences of the line command. This command syntax will become clearer with examples.

The insert command, I or In, causes insertion of blank lines beginning after the line where the command is entered. The inserted lines are given null line numbers initially. After data have been entered on the inserted lines and the enter key is pressed, the new lines are numbered, existing virtual line numbers are renumbered, and any inserted new lines on which no data have been entered disappear.

The delete command, D, Dn, or DD, will delete one or more lines of data. If Dn is entered in a line number field, a total of *n* lines beginning with that line will be deleted. If DD is entered in the line number fields of two lines, the block of lines between them will be deleted.

The move (M, Mn, MM) and copy (C, Cn, CC) commands designate a line or block of lines to be moved or copied to another location within the file. Move differs from copy in that the lines are deleted from their original location after a move. This location is specified as after (A) or before (B) some other line of data, with A or B entered in the line number field of the target location. If An is specified, the block that is being moved or copied will be repeated *n* times after the target line; Bn can be used similarly.

Lines also can be "repeated." R will duplicate the specified line, and Rn will duplicate this line *n* times. Similarly, RRn entered on one line with RR entered on another line will duplicate the block of lines between them *n* times.

Parentheses, greater than, and less than symbols are quite useful as line commands in formatting structured program code. Entering) causes the entire contents of the line to be shifted one position to the right, while)n shifts all the data in the line *n* columns to the right. The block command))n and)) will shift the data in the entire block of lines *n* columns to the right. To shift data *n* columns to the left, the commands (, (n, ((, and ((n are used.

If a program contains labels or comments at the beginnings of lines that are *not* to be shifted while the body of the program is moved to the left or right, the paired commands < and <n, << and <<n, > and >n, and >> and >>n are used in the same way as the parentheses above. In any given line, these commands will shift a line left or right *excluding* any word beginning in column one. This feature allows code to be shifted to the right in pursuit of structured formatting conventions without disturbing labels that begin in column one.

DISCOVER THE LANGUAGE OF ARTIFICIAL INTELLIGENCE PROLOG V

Interpreter for MS-DOS/PC-DOS

At last! A Prolog with enough muscle to handle real-world applications for UNDER \$100! Discover why Japan has chosen Prolog as the vehicle for their "Fifth Generation Machine" project to design intelligent computers.

CHOOSE FROM TWO GREAT VERSIONS:

PROLOG V-Plus

\$99.95

- More Than 100 Predefined Predicates
- Large Memory Model (to 640K)
- Floating Point Arithmetic
- 150-Page User's Manual and Tutorial plus Advanced Programming Documentation
- Co-Resident Program Editor
- Calls to Co-Resident Programs
- Text and Graphic Screen Manipulation

STANDARD FEATURES ON BOTH:

- Clocksin & Mellish-Standard Edinburgh Syntax.
- Extensive Interactive Debugging Facilities

THE CHOICE OF UNIVERSITIES

Generous university site licenses and an excellent teaching tutorial and reference guide have made PROLOG V the choice of universities nationwide. Call for details.

PHONE ORDERS: 1-800-621-0852 EXT 468

PAYMENT ENCLOSED \$ _____
CA residents add 6% sales tax

CHARGE MY: MasterCard Visa

Card No. _____ Exp. Date _____

Signature _____

Mr./Mrs./Ms. _____
(please print full name)

Address _____

City/State/Zip _____

PROLOG V-Plus \$99.95
PROLOG V 69.95
UPGRADE ONLY 40.00
Return factory diskette and
\$30 plus \$10 Handling

SHIPPING:
\$ 5.00 U.S.
7.50 Canada
10.00 Caribbean,
Hawaii Air
20.00 Overseas Air

COD Orders Not Accepted
15 day check clearance



CHALCEDONY
SOFTWARE

5580 LA JOLLA BLVD.
SUITE 126
LA JOLLA, CA
92037
(619) 483-8513

CIRCLE NO. 122 ON READER SERVICE CARD



A red diagonal banner with white text. The text reads "DEMONSTRATION DISKETTE ALICE" at the top, followed by "Call 1-800-448-3400 ext. 1-800-387-9018" and "(In Canada 1-800-387-9018)" below it.

Someone new has just entered the world of programming.

Now, everyone can program their computer. Because now, there's *ALICE* to show you the way.

ALICE: The Personal Pascal...the first complete programming environment that lets you create your own sophisticated Pascal programs, while teaching you how.

Much More Than a Pascal Compiler

ALICE knows the syntax and the rules of Pascal... changing programming from what was once a slow, complex task to simply a matter of selecting the appropriate templates, and merely filling in the blanks. You can't make a frustrating syntax error. *ALICE* won't let you.

The Programming System With a Difference

ALICE has a unique Pascal interpreter that lets you run — and debug — your programs directly. You can actually see your program executing. And the programs that you develop with *ALICE* can be used with your Pascal compiler.

Help at Your Fingertips

All the information you'll ever need from ALICE. A tutorial, features of Pascal, and the meaning of error messages is now at hand...in over 500 screens of on-line HELP.

Let ALICE be the Teacher

ALICE is currently being used in hundreds of schools to teach Pascal programming. Why Pascal? Because it has emerged as the language of choice of colleges and universities and is now the official language of the SAT examinations.

ALICE Offers More!

- windows, menus, and function keys . . . easy.
 - "undo" feature to take back mistakes . . . forgiving.
 - screen control, color highlighting, and macros . . . powerful.

Now you'll program intelligently, accurately, almost intuitively...with ALICE. To order by credit card, call 1-800-448-3400 ext. ALICE (In Canada 1-800-387-9018). Specify software or demonstration diskette. Or, fill in the order form and send to:

SOFTWARE CHANNELS

INC.

Software Channels Inc.
Four Kingwood Place,
Kingwood, Texas 77339 (713) 359-1024

Canada and International:
212 King Street West,
Toronto, Canada M5H 1K5 (416) 591-9131

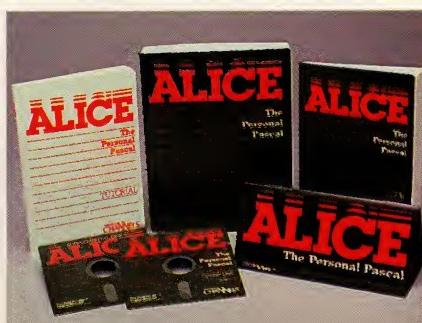
ALICE

The Personal Pascal™

For IBM PC, XT, AT and compatibles

ALICE: The Personal Pascal software prices include shipping and handling to the U.S. and Canada. COD's will not be accepted. Texas residents add 6% sales tax. Ontario residents add 7% sales tax.

Dealer and distributor inquiries welcome. Site licences available.



CIRCLE NO. 246 ON READER SERVICE CARD



*The World's
Best Selling
Multi-User
Database
For Five Years
Running.*

DATAFLEX

DataFlex versions are available
for all popular single-user and multi-user
operating systems, including Xenix.

For a free copy of this poster
(minus ad copy), write Data Access Corp.
or leave a message on our
Bulletin Board System: (305) 238-0640.

DATA ACCESS CORPORATION
8525 S.W. 129th Terrace - Miami - FL - 33156-6565 (305) 238-0012 - Telex 469021 DATA ACCESS CI
CIRCLE NO. 118 ON READER SERVICE CARD

SPF EDITORS

In editing a long program, it is often desirable for the user to simultaneously view two segments that are separated from one another by many lines. Splitting the screen will not help, because two edit sessions cannot edit the same file at the same time. The solution is to exclude a number of lines from the display by entering X, Xn, XX, or XXn, as with the other commands above. The excluded lines are replaced on the screen by a single line that displays a count of the lines excluded. These lines all can be redisplayed with the RESET primary command, or brought back selectively with the show command, S or Sn, to show one or *n* lines. To show only the first few excluded lines, the user enters F or Fn in the line number field on the line representing the excluded lines; L or Ln rediscusses a line or a block that begins with the last of the excluded lines.

Lines or blocks of lines can be combined using the overlay command, O, On, or OO, to designate the target lines to be overlaid, and copying (C, Cn, CC, CCn) or moving (M, Mn, MM, MMn) other lines over them. Only the blanks in the overlay target lines will be overlaid. A common use of this tool in creating documentation is to set two columns of data side by side, by first right-shifting one set of lines, then overlaying the lines already containing what is to appear in the left column.

In writing documentation, it is particularly useful to emulate word processing data entry techniques by allowing the user to disregard line boundaries and *power type*. Power type is unformatted data entry that later must be flowed into current text boundaries—the user simply types away without being concerned with carriage returns and line divisions. The TE_n command will insert *n* blank lines for data entry of this type, deleting any unused blank lines when Enter is pressed. If TE is entered without an integer, blank lines will fill the screen from the line on which the command was entered through the bottom line of the screen; if Enter is pressed when the end of the last data entry line provided is reached, more blank lines are generated for further data entry. In either case, when Enter is pressed (for a second time, if more data entry lines have been generated), unused blank lines will disappear and the data will be "flowed" to fit neatly within the column boundaries that have been established using the BOUNDS command, and line numbers for the new lines will be generated. During data entry, the line number field

is protected, and the user is able to enter data without concern.

The text flow (TF) command realigns data already entered to fill out lines within the BOUNDS established. This command flows the data contained on all lines beginning with the line where the command is entered and ending with the first all-blank line encountered, assumed by the product to designate the "end of the paragraph" in documentation. If TFn is entered, the right boundary established by BOUNDS will be overridden by column *n*.

If insertion in the middle of a currently existing line is required, the insert (I) command is inadequate. In this case, a variation on insert, the text split command (TS), is used. TS is entered in the line number field, the cursor is positioned on the line where insertion is to occur, and Enter is pressed. If more than one line must be inserted, TS*n* will insert *n* lines between the two designated segments of the line that is being split. After insertion is complete, the text can be neatly flowed back together using TF. Again,

SideTalk™

It minds the phone while you do your work

No more interruptions! Because now SideTalk can transfer your files or receive your mail while you're using your computer for other important matters. And SideTalk is programmable with its own BASIC-like language. What's more, you're never more than a keystroke away from all the power of SideTalk.

When we say SideTalk is the best telecommunications program on the market, we're not just talking out of the side of our mouth.



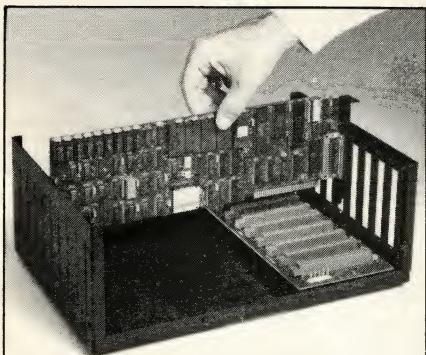
To place your order:
Lattice, Incorporated
Post Office Box 3072
Glen Ellyn, Illinois 60138
312-858-7950
TWX 910-291-2190



Only
\$119.95



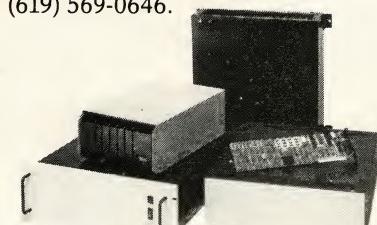
The PC Bus: Cost-Effective, Board-Level Solution To System Integration



Get your dedicated system to market *months* sooner with the PC Bus. Full board-level implementation by I-Bus lets you plug together system components from hundreds of PC Bus board manufacturers, and directly execute software developed on and for the IBM® PC.

I-Bus has board-level CPU's with 8088 or 80188 processors, full disk or diskless operation and up to 160K of EPROM, 256K of RAM on board. We have the most complete line of system packaging for the PC Bus, too.

Start cutting your schedule today—give us a call today at (800) 382-4229. In California, call (619) 569-0646.



I-BUS
SYSTEMS

9235 Chesapeake Drive
San Diego, CA 92123

SPF EDITORS

TABLE 6: General Features

	APS/SPF	HCS ED.	MIC./SPF	SPF/PC	ISPF
Version reviewed	2.2	10/19/85	3.2	1.82	N/a
Language written in	Assembly	C	C	Assembly	N/a
Supports					
PC	Yes	Yes	Yes	Yes	N/a
PC/XT	Yes	Yes	Yes	Yes	N/a
PC/AT	Yes	Yes	Yes	Yes	N/a
3270-PC	Yes	Yes	Yes	Yes	N/a
DOS 2.0	Yes	Yes	Yes	Yes	N/a
DOS 3.0 and 3.1	Yes	Yes	Yes	Yes	N/a
Documentation					
Complete	Excel.	Fair	Excel.	Fair	Excel.
Correct	Fair	Fair	Fair	Fair	Fair
Well written	Fair	Fair	Excel	Fair	Fair
Use sample screens	Fair	Fair	Excel.	Fair	Excel.
Index	No	Yes	Yes	No	Yes
Table of contents	Yes	Yes	Yes	Yes	Yes
Template	No	No	Yes	No	Yes
Reference card	No	No	No	No	Yes
On-disk tutorial	Yes	No	Yes	Yes	Yes
Number of diskettes	2	1	1	1	N/a
Number of files	23	7	2	5	N/a
Copy protected	No	No	No	No	N/a
Minimum KB	256	192	320	192	N/a
Size cmd. files (bytes)	124,503	139,908	287,040	130,816	N/a
Size other files (bytes)	135,399	33,751	0+cat (var)	966	N/a
Minimum line length	40	0	0	1	N/a
Max. line length (bytes)	248	254	255	954	255(F)/ 254(V)
Max. line length, Browse (bytes)	256	254	255	954	32,767
Maximum file size	Pgs ^a	Memory	Pgs ^a	Pgs ^a	N/a
Max. file size, Browse	Pgs ^a	640KB	Pgs ^a	Pgs ^a	N/a
Helps	Yes	Yes	Yes	Yes	Yes
Context sensitive	Yes	No	Yes	No	Yes
Tutorial	Yes	Yes	Yes	Yes	Yes
DOS path support					
Parameter files	Yes	Yes	N/a	Yes	N/a
Data files	Yes	Yes	Yes	Yes	N/a
Run from any directory	Yes	Yes	Yes	Yes	N/a
Data access any direct.	Yes	Yes	Yes	Yes	N/a
DOS command processor					
Off main menu option	Yes	N/a	Yes	Yes	Yes
Off cmd. line (DOS)	Yes	Yes ^b	Yes	Yes	Yes ^c
Browse available	Yes	Yes	Yes	Yes	Yes
Full featured	Yes	Yes	Yes	Yes	Yes

this function is useful chiefly for writing documentation on this editor.

In case of errors in entering line commands in the line number field, a correct command can be entered and executed, or the erroneous line commands can be deleted or typed over with a blank or any line number. ISPF will redisplay the original line numbers when Enter is pressed. Some of the products reviewed had trouble with this correction capability, as will be discussed further on.

Browse. A subset of edit features is provided to enable the user to BROWSE a file. No changes can be made to a file that is being BROWSED, making most edit commands unnecessary. Browse is a main menu option separate from the edit option. Its available features include LOCATE, FIND, COLS, CAPS, RESET, and all the features of the HEX command except data modification.

File organization. TSO/ISPF supports partitioned data sets (PDSs). Each PDS is a file that is itself partitioned into files

	APS/SPF	HCS ED.	MIC./SPF	SPF/PC	ISPF
Split screen Utilities	(SWAP)	Yes	Yes	(SWAP)	Yes
Library	Yes	No	Yes	Yes	Yes
Dataset	Yes	No	Yes	Yes	Yes
Move/copy	Yes	No	No	Yes	Yes
Cmd. line on edit screen	Yes	No	Yes	No	Yes
Foreground processing	No	No	Yes	No	Yes
Background processing	Optional	No	No	No	Yes
FIND count	Yes	Yes	Yes	Yes	Yes
CHANGE count	Yes	Yes	Yes	No	No
Flag changed lines	No	Yes	Yes	Yes	Yes
Encryption	No	Yes	No	No	No
Customize capability					
Functions	Extensive	Limited	Extensive	Extensive	No
Keys	Yes	Yes	Yes	Yes	No
Screens	No	Yes	No	No	Limited
Screen color control	No	Yes	No	Yes	No
Jump func. (=option)	Yes	Yes	Yes	Yes	Yes
Snow problem	No	No	Yes	Yes	No
Snow suppressor	No	No	Yes	Yes	No
Convenience features/displays					
Date	No	No	Yes	No	No
Time	No	No	Yes	Menu only	FUNC only
Disp. amt. free mem.	No	Yes	No	Yes	N/a
Show prog. drive/path	No	No	Yes	No	N/a
Disp. line, col. no.	No	Yes	No	Yes	No
Display file name	Yes	Yes	Yes	Yes	Yes
Display cols. displayed	Yes	No	Yes	Yes	Yes
Emulation of TSO/ISPF PDS					
TSO file names	Yes	Yes	Yes	Yes	Yes
PDS emul.-name table	No	No	Yes	No	N/a
PDS emul. as paths	Yes	Yes	No	Yes	N/a
Concat. of libraries	No	No	No	No	Yes
.EXTENSION =data set type	Yes	No	Yes	Yes	Yes
STATS display	No	No	Yes	No	Yes
TSO name list option	Yes	Yes	Yes	No	Yes
Directory selection	Yes	Yes	Yes	Util. only	Yes
Sorted list of files	Yes	Yes	Yes	Yes	Yes
DOS-style statistics	Yes	Yes	Yes	Yes	N/a
TSO-like statistics	No	No	Yes	No	N/a

^a Pages in and out; unlimited.

^b DOS command must be preceded by \$.

^c TSO command.

While HCS Editor is by far the least expensive of the products reviewed, it deviates significantly from the mainframe ISPF editor standard. None is copy protected.

that are called *members* of the PDS within the space that it occupies. As a feature of several of the ISPF menu screens, a sorted list of files within a PDS, or within a concatenation of PDSs, can be displayed by leaving the member field on the menu blank. A member of the list then can be selected for editing or browsing by entering an S in the field preceding the name of the desired file. In the same way, utility functions can provide similar sorted lists of members of PDSs, allowing for deletion, re-

naming, etc. of members by entering a one-letter function code in the field before the name of each member to be acted upon. In the list, various statistics are displayed for each member, including the dates when each member was created and was last modified, each member's size, and so on.

In short. The edit features of IBM's mainframe ISPF product are powerful and worthy of emulation on the microcomputer. The usefulness of such products is apparent, whether the objective

is stand-alone editing of program code for execution on the PC itself, or the use of the PC as a distributed workstation to edit code that will be compiled on either the PC or the mainframe, and executed on the mainframe.

PC SPF IN ACTION

Four products were reviewed: Arrix Logic Systems' Advanced Productivity System APS/SPF (release 2.2), Command Technology Corporation's SPF/PC (release 1.82), Heuristic Computer Systems' HCS Editor (release dated 10/19/85), and PHASER's micro/SPF (release 3.2). Their prices range from a low of \$49.95 for HCS Editor to a high of \$195.00 for SPF/PC, with APS/SPF priced at \$145.00 and micro/SPF at \$175.00.

None is copy protected. Table 6 summarizes the features of these products.

Support. All of these products support the PC, PC/XT, PC/AT, and the 3270-PC, and DOS 2.0, 3.0, and 3.1. Their memory requirements range from a low of 192KB for SPF/PC and HCS Editor to a high of 320KB for micro/SPF. SPF/PC, micro/SPF, and APS/SPF theoretically are unlimited in the size of the files they can browse and edit because they support paging of edit files into and out of memory. HCS Editor supports the use of all memory not used by the program up to 640KB for files being edited. In addition, SPF/PC claims to support the Lotus/Intel/Microsoft extended memory specification, and both SPF/PC and micro/SPF support AT extended memory. Without access to AT extended memory or AboveBoard-type memory, these claims could not be verified.

All four products have full-featured browse as well as edit capability. All four support DOS paths, both for the location of the program and any parameter files required, and for the location of data files to be edited or browsed.

Compatibility. According to the vendors, the products are compatible with TopView, various LANs, mainframe communications products, and compilers.

More specifically, SPF/PC and micro/SPF offer extensive support for interaction with other products, such as multitasking available using TopView, and popular networks. micro/SPF is compatible with the Novell and 3Com networks, but has not been tested with the IBM Sytech. SPF/PC is compatible with Novell and IBM Sytech. (This information was supplied by the vendors; testing compatibilities with the extensive range of other products available lies beyond the scope of this review.)

Integrated product lines. APS/SPF is part of a series of integrated PC programmer

SPF EDITORS

productivity products, including an optional product to submit and run jobs in the background, and an optional emulation of the ISPF Dialog Manager, which permits existing ISPF menu screens to be customized, as well as the creation of new ones designed to support new applications that will be developed for the IBM PC.

Functionality. All the products permit two concurrent edit or browse sessions. micro/SPF and HCS Editors support a split screen as in mainframe ISPF, while SPF/PC and APS/SPF switch between two

screens, each of which occupies the entire screen while active. All support the jump (=option) function.

Utilities. Several of the utilities available under mainframe ISPF are supported by the products reviewed. Both SPF/PC and APS/SPF offer library, file, and move/copy utilities. These functions provide for file naming, renaming, deletion, and other features. The micro/SPF product includes the library and file utilities only. The exact implementation of each of these utilities varies from product to product, except for the HCS Editor,

which lacks such explicit utilities. Many of IBM's ISPF utility options are useful only in the mainframe environment and are not missed on the PC.

Convenience features. A number of these are provided. All four products display the name of the file being edited, and all except HCS Editor show the numbers of the columns currently being displayed. The line and column coordinates of the current position of the cursor, a familiar word processing feature, is implemented by HCS Editor and by SPF/PC. The amount of free memory available is indicated by SPF/PC and by HCS Editor, while micro/SPF displays the name of the active disk drive. SPF/PC displays the current time on the menu only, while micro/SPF displays both date and time at all times.

Like mainframe ISPF, all four products allow that functions assigned to the function keys be customized by the user. Most allow that various other keyboard elements be customized as well. While mainframe ISPF allows the user to customize the screen only to the extent of moving the command line from the top to the bottom of the screen, HCS Editor provides substantial options to customize the screen display viewed by the user. Both SPF/PC and HCS Editor allow for user selection of the color of the screen display.

Hexadecimal displays. All four products have a HEX function that displays two ASCII digits vertically below each character. Only micro/SPF can display the ASCII in horizontal DATA format as well. All the editors except HCS Editor have an EBCDIC feature. SPF/PC and micro/SPF simply display the EBCDIC equivalents of the ASCII characters in the file. Thus, these two editors display an ASCII file's characters' hexadecimal equivalents in both ASCII and EBCDIC. However, in EBCDIC mode, APS/SPF interprets the data as if they were EBCDIC rather than ASCII. It therefore can make sense of actual EBCDIC files, which display as gibberish in APS/SPF's ASCII mode, and in both the ASCII and EBCDIC modes of SPF/PC and micro/SPF. This was discovered when a file in EBCDIC was loaded to all four products and display was attempted. Only APS/SPF and SPF/PC allow the user to modify the data when displayed as EBCDIC, and of the two, only APS/SPF performs the modifications correctly.

Speed and performance. Table 7 summarizes a variety of load, find, and change benchmarks run on two different files using the four products on both a PC/XT and a PC/AT. The PC/XT used was equipped with DOS 2.0, 640KB, a Her-

ONE-STOP ARCnetTM LAN SOLUTIONS

Now you can get all the tools you need to build industry standard **TOKEN-PASSING** networks from one source.

InterContinental Micro.

Our networking packages let you configure any combination of nodes (PC's and compatibles, ATs, XT's, Jrs., Z-100's) to a common Fileserver in just a few minutes with our menu-driven installation program.

Active and passive hubs allow you to integrate up to 255 users on a single network with *increased* efficiency as the network grows.

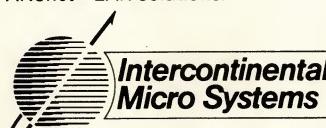
In addition, our stand-alone ARCnetTM Workstation/Fileserver and complete line of S-100 Bus products (single board computers, slaves and controllers) give you and your customers even more options.

ARCnet is a trademark of Datapoint Corporation.

We're also compatible with other industry-leading ARCnet PCTM and S-100 products, and our PC networking boards include an optional 256K of system RAM.

All with InterContinental Micro's reputation for outstanding reliability, exceptional service, and highly competitive pricing.

Call InterContinental Micro today, or circle the bingo number below for ARCnetTM LAN solutions.



4015 Leaverton Court, Anaheim, CA
92807; Phone: (714) 630-0964
Telex: 821375 SUPPORT UD: Easylink: 62562040.



CIRCLE NO. 117 ON READER SERVICE CARD

PERFORMANCE PACKAGE

Blaise Computing Inc. introduces
the PERFORMANCE PACKAGE™ for Turbo Pascal programmers.

TURBO PASCAL

Turbo ASYNCH™

With Turbo ASYNCH, you can be in constant touch with the world without ever leaving the console. Rapid transit at its best. Turbo ASYNCH is designed to let you incorporate asynchronous communication capabilities into your Turbo Pascal application programs, and it will drive any asynchronous device via the RS232 ports, like printers, plotters, modems or even other computers. Turbo ASYNCH is fast, accurate and lives up to its specs. Features include...

- ◆ Initialization of the COM ports allowing you to set all transmission options.
- ◆ Interrupt processing.
- ◆ Data transfer between circular queues and communications ports.
- ◆ Simultaneous buffered input and output to both COM ports.
- ◆ Transmission speeds up to 9600 Baud.
- ◆ Input and output queues as large as you wish.
- ◆ XON/XOFF protocol.

The underlying functions of Turbo ASYNCH are carefully crafted in assembler for efficiency, and drive the UART and programmable interrupt controller chips directly. These functions, installed as a runtime resident system, require just 3.2K bytes. The interface to the assembler routines is written in Turbo Pascal.

The Turbo Pascal PERFORMANCE PACKAGE™ is for the serious Turbo Pascal programmer who wants quality tools to develop applications. Every system comes with a comprehensive User Reference Manual, all source code and useful sample programs. They require an IBM PC or compatible, utilizing MS-DOS version 2.0 or later. There are no royalties for incorporating PERFORMANCE PACKAGE functions into your applications.

Turbo POWER TOOLS and Turbo ASYNCH sell for \$99.95 each, and they may be ordered directly from Blaise Computing Inc. To order, call (415) 540-5441.

BLAISE COMPUTING INC.

BLAISE

Watch us!

CIRCLE NO. 114 ON READER SERVICE CARD

NEW!

Turbo POWER TOOLS™

Turbo POWER TOOLS is a sleek new series of procedures designed specifically to complement Turbo Pascal on IBM and compatible computers. Every component in Turbo POWER TOOLS is precision engineered to give you fluid and responsive handling, with all the options you need packed into its clean lines. High performance and full instrumentation, including...

- ◆ Extensive string handling to complement the powerful Turbo Pascal functions.
- ◆ Screen support and window management, giving you fast direct access to the screen without using BIOS calls.
- ◆ Access to BIOS and DOS services, including DOS 3.0 and the IBM AT.
- ◆ Full program control by allowing you to execute any other program from within your Turbo Pascal application.
- ◆ Interrupt service routines written entirely in Turbo Pascal. Assembly code is not required even to service hardware interrupts like the keyboard or clock.

Using Turbo POWER TOOLS, you can now "filter" the keyboard or even DOS, and create your own "sidekickable" applications.

YES, send me the Best for the Best! Enclosed is _____ for
 Turbo ASYNCH Turbo POWER TOOLS. (CA residents add
6 1/2% Sales Tax. All orders add \$6.00 for shipping.)

Phone:

Name: _____

Shipping Address: _____

State: _____ Zip: _____

City: _____ Exp. Date: _____

VISA or MC #: _____

Turbo Pascal is a trademark of Borland International. Turbo POWER TOOLS, Turbo ASYNCH and PERFORMANCE PACKAGE are trademarks of Blaise Computing Inc. IBM is a registered trademark of International Business Machines Corporation. MS-DOS is a trademark of Microsoft Corporation.

- ◆ 2034 BLAKE STREET
- ◆ BERKELEY, CA 94704
- ◆ (415) 540-5441

TABLE 7: Benchmark Performance

	PC/AT				PC/XT			
	APS/SPF	HCS ED.	MICRO/SPF	SPF/PC	APS/SPF	HCS ED.	MICRO/SPF	SPF/PC
Load editing program	2.00	2.00	3.00	1.00	9.00	5.00	9.00	5.50
Load 8,000-byte file (80 lines)	1.00	1.00	0.50	0.50	2.50	2.00	3.00	1.50
FIND string near end of file (1)	0.50	0.25	0.25	0.25	0.50	0.50	0.50	0.50
FIND ALL strings (3)	0.25	0.25	0.25	0.25	0.50	0.50	0.50	0.50
CHANGE ALL strings (3)	0.25	0.25	0.25	0.25	0.50	0.50	0.50	0.50
FIND ALL of one char. (680)	0.50	0.50	0.50	2.25	1.00	1.00	1.50	2.00
CHANGE ALL of one character (680)	0.50	0.75	1.50	2.75	1.50	1.00	3.50	2.00
FIND ALL of one string (600)	0.50 ^a	0.50 ^a	0.50	2.25	0.50 ^a	1.00 ^a	1.50	2.00
FIND ALL of one char. (6,465)	2.25	0.50 ^a	4.00	24.00	5.50	1.00 ^a	12.00	11.00
FIND ALL of one hex string (6,465)	2.25	0.50 ^a	4.00	Can't	5.50	1.00 ^a	12.00	Can't
FIND ALL using picture string (699)	1.00	Can't	1.00	Can't	2.00	Can't	2.50	Can't
FIND ALL chars using picture string (8,000)	2.50	Can't	5.00	Can't	7.00	Can't	14.00	Can't
Load 165,200-byte file (2,065 lines)	25.00	16.00	16.00	13.00	62.00	43.00	22.00	34.00
RESET	1.00	0.50	0.50	0.50	1.50	1.50	1.50	1.00
SCROLL LEFT/RIGHT	0.25	0.50	1.00	0.25	0.25	0.25	0.25	0.10
MAX up/down	0.50	0.50	1.00	0.25	1.00	1.00	0.25	0.25
FIND string near end of file (1)	1.50	8.00	8.00	5.00	3.00	22.00	8.50	2.00
FIND ALL strings (3)	1.50	8.00	10.00	5.00	3.50	22.00	8.50	2.00
CHANGE ALL strings (3)	1.50	8.00	10.00	5.00	3.50	22.00	8.50	2.00
FIND ALL of one character (14,042)	5.00	10.00	22.00	57.00	14.00	28.00	33.00	35.00
CHANGE ALL of one character (14,042)	7.00	15.00	37.00	57.00	19.00	37.00	82.00	36.00
FIND ALL of one string (12,390)	2.00 ^a	9.00 ^a	21.00	52.00	5.00 ^a	23.00 ^a	31.00	32.00
FIND ALL of one character (132,140)	37.00 ^a	27.00 ^a	85.00 ^a	503.00 ^a	104.00 ^a	73.00 ^a	233.00 ^a	315.00 ^a
FIND ALL of same string in hex (132,140)	37.00 ^a	27.00 ^a	85.00 ^a	Can't	104.00 ^a	73.00 ^a	233.00 ^a	Can't
FIND ALL spec. chars using P'\$ (146,621)	45.00 ^a	Can't	97.00 ^a	Can't	126.00 ^a	Can't	265.00 ^a	Can't
FIND ALL chars, pic string P=' (165,200)	45.00 ^a	Can't	102.00 ^a	Can't	132.00 ^a	Can't	287.00 ^a	Can't

^a This product's count of string occurrences does not agree with that obtained by a SNOBOL string-counting program on the PC.

Note: all times are in seconds.

Different interpretations of a string occurrence lead to differences in counts by mainframe ISPF and by the SPF editors.

cules Color Card, and a Taxan RGB 425 monitor; the PC/AT was equipped with DOS 3.1, 512KB, an IBM color graphics card, and an IBM color monitor. All files were loaded from directories located on the hard disks to minimize I/O time not directly associated with the software's performance. Not all tests could be run in all cases because of some specific product limitations.

Generalizations can be made from these results. Particularly on the AT, the performance of all products was generally acceptable in handling the smaller file. When the large file was edited, APS/SPF and SPF/PC were unusually fast

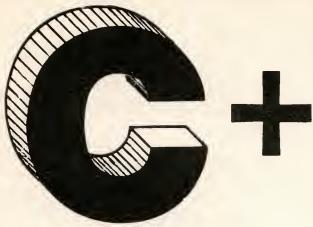
in handling "normal" requests involving single or multiple find or change requests for target strings that occur infrequently in the document.

The determination of which product performed better depended upon the hardware. Although the AT is ordinarily faster than the XT, the AT used had less memory than the XT. SPF/PC's optimizations seem to become millstones when it is asked to crunch large numbers of searches for strings recurring so often as to constitute the bulk of the document. Under similar circumstances, micro/SPF also performed slowly. APS/SPF is generally ahead on

this score, although table 7 should be examined with care if speed is an important consideration.

Incidentally, the counts of strings found provided by the software occasionally varied from those that would be found using mainframe TSO/ISPF. Consider, for example, the task of counting the number of times a substring such as ***** might be found in a string such as

Mainframe ISPF, micro/SPF, and SPF/PC would all find this substring 30 times in this string—the first beginning at posi-



The Best C Book

A Powerful C Compiler

One Great C Value \$39.95

A good C book just isn't complete without a good C compiler to go with it. That's why we give you both. You get a comprehensive 450 page book and a full feature standard K&R C compiler with the Unix V7 Extensions. The Book is loaded with examples that teach you how to program in C. And our fast one pass C compiler comes with an equally fast

linker so you don't waste a lot of time watching your disk drives spin. You also get a Unix compatible function library that contains more than 150 functions (C source code included). And if all that isn't enough, we offer you a 30 day money back guarantee. So what are you waiting for? The exciting world of C is just one free phone call away.

Language Features

- Data Types: char, short, int, unsigned, long, float, double
- Data Classes: auto, extern, static, register
- Typedef, Struct, Union, Bit Fields, Enumerations
- Structure Assignment, Passing/Returning Structures

abs	conbuf	feof	getseg	isascii	movmem	replace	strcat
asm	conc	ferror	getdseg	iscntrl	open	repmem	stremp
asmx	cos	fflush	getd	isdigit	outp	rewind	strcpy
atan	cpsytr	fgets	putd	islower	peek	right\$	strlen
atof	creat	fileno	getdate	isprint	perror	rindex	strncat
atoi	cursblk	filetrap	gettime	isspace	poke	rmdir	strncmp
atol	curslin	floor	geti	isupper	poscurs	scanc	strncpy
bdos	curlsol	fopen	puti	itoa	pow	setbuf	strsave
bdosx	currow	fprintf	getkey	keypress	printf	setbufsiz	system
bios	cursoff	fputs	getmode	left\$	putc	setcolor	tolower
biosx	cursor	free	setmode	len	putchar	setdate	toupper
calloc	delete	fread	gets	log	putw	setjmp	ungetc
ceil	drand	free	getw	log10	rand	setmem	unlink
cfree	exec	freopen	heapsiz	longjmp	read	sin	write
chain	exec1	fscanf	heaptrap	lseek	readattr	sound	writchs
character	execv	fseek	hypot	index	malloc	sprint	xmembeg
chdir	exit	ftell	mathtrap	alloc	reach	writech	xmemend
chmod	exitmsg	fwrite	mid\$	realloc	readdir	sqrt	xmemget
clearerr	exp	getc	iofilter	mkdir	writedot	strand	xmemput
close	fabs	getch	isalnum	modf	realloc	sscanf	xmovmem
clrscr	fclose	putch	isalpha	rename	str	stacksiz	_exit
cmpstr	fdopen	getchar					

Functions

movmem	replace	strcat
open	repmem	stremp
outp	rewind	strcpy
peek	right\$	strlen
perror	rindex	strncat
poke	rmdir	strncmp
poscurs	scanc	strncpy
pow	setbuf	strsave
printf	setbufsiz	system
putc	setcolor	tolower
putchar	setdate	toupper
putw	setjmp	ungetc
rand	setmem	unlink
read	sin	write
readattr	sound	writchs
malloc	sprint	xmembeg
alloc	writech	xmemend
realloc	sqrt	xmemget
realloc	strand	xmemput
str	sscanf	xmovmem

MIX Editor \$29.95

When you're programming in a high level language you need a high powered editor. That's why we created a programmable full/split screen text processor. It lets you split the screen horizontally or vertically and edit two files at once. You can move text back and forth between two windows. You can also create your own macro commands from an assortment of over

100 predefined commands. The editor comes configured so that it works just like Wordstar but you can change it if you prefer a different keyboard layout. The editor is a great companion to our C compiler. Because they work so well together we want you to have both. To make sure you do, we're offering the editor for just \$15 when purchased with the C compiler.

ASM Utility \$10

The ASM utility disk allows you to link object files created by Microsoft's MASM or M80 assemblers. Lots of useful assembly language functions are included as examples.

ORDERS ONLY
1-800-523-9520
IN TEXAS
1-800-622-4070

Canadian Distributor
Saraguay Software: 416-923-1500

CIRCLE NO. 125 ON READER SERVICE CARD

NOT COPY PROTECTED

Editor	\$ _____	(29.95)
C	\$ _____	(39.95)
C & Editor	\$ _____	(54.95)
ASM Utility	\$ _____	(10.00)
TX Residents	\$ _____	(6.125% sales tax)
Shipping	\$ _____	(see below)
Total	\$ _____	
<input type="checkbox"/> Check <input type="checkbox"/> Money Order		
<input type="checkbox"/> MC/Visa*	\$ _____	Exp _____
Shipping Charges: (No charge for ASM Utility)		
USA:	\$5/Order	
Canada:	\$10/Order	
Overseas:	\$10/Editor • \$20/C • \$30/C & Editor	

- PCDOS/MSDOS (2.0 or later)
 IBM PC Single Side
 IBM PC Double Side
 Tandy 2000
 8 Inch
 Other _____
- CPM 80 (2.2 or later)
 8 Inch
 Kaypro II
 Kaypro 4
 Apple (Z80)
 Osborne I SD
 Osborne I DD
 Morrow MD II
 Other _____

Name _____
 Street _____
 City _____
 State _____
 Zip _____
 Country _____
 Phone _____

MIX
software 2116 E. Arapaho
Suite 363 Richardson, TX 75081
(214) 783-6001

Ask about our volume discounts.

SPF EDITORS

tion 1, the second at position 2, and so on. APS/SPF and HCS Editor, on the other hand, start looking for the next occurrence of the substring on the character beyond the end of the last occurrence; that is, it locates the substring at position 1, position 6, position 11, and so on. This accounts for one kind of variation in substring counts.

In the case of the very large numbers of string occurrences in the big file, tab characters can account for differences in counting padded blanks. Even when all blanks have been replaced with some other character, some of the counts differ from counts obtained on the personal computer, using a string-counting program written in SNOBOL for this purpose. The products' reliability in counting very large numbers of strings is an unresolved issue that would be a detriment only in unusual situations.

STRONG AND WEAK

APS/SPF. APS/SPF's strongest point is that it is a part of an integrated series of products for a distributed programmer workstation. Rather than depending upon compatibility with other products on the market, ALSI provides as extra-cost options features beyond the edit capability reviewed here, including a job submission utility and a microcomputer version of ISPF Dialog Manager, allowing the programmer to design and implement menus and screens.

In addition, this product was one of the two speediest in the benchmarks; on the AT it was consistently the fastest, except in some highly repetitive tasks.

The documentation is unusually complete and thorough, but may be hard to reference due to its lack of an index. The system can be extensively customized and tuned by the user. Considerable control over the location of the virtual memory for swapping is possible, so that a RAM disk could be exploited to improve performance.

On the other hand, only swap-screen, rather than full split-screen capability, is available under APS/SPF. Another limitation is that the minimum line length is 40 characters, in contrast with zero or one-character minimum line length with the other products. This might not concern individuals using only 80-character card images. Lines entered with fewer than 40 characters are padded out to 40 with blanks. APS/SPF's profile command displays three toggles present in mainframe ISPF (RECOVERY, NULLS, and AUTOBAK) that are *not* implemented in this software and *cannot* be turned on and off.

These nonexistent toggles are displayed simply to make the screens resemble those of mainframe ISPF.

Many of the FIND and CHANGE parameters of mainframe ISPF are absent, including FIRST, LAST, PREV, PREFIX, SUFFIX, and WORD.

APS/SPF exhibits differences in the default implementations of several functions: the Home key does not work on the file selection screens, and on the edit screen, hitting it repeatedly causes alternation between the command and the scroll parameter fields, rather than repeated returns to the command field. Pressing the END function key from APS/SPF's main menu will not terminate the session, as it will in mainframe ISPF, micro/SPF, HCS Edit, and SPF/PC; the letter X must be pressed instead. These changes could be regarded as improvements or as distractions to those familiar with mainframe standards.

The default Tab key function will not take the cursor off the command line. Once the cursor is on a data line, the tab key will not take the cursor into the line number field as with mainframe ISPF and the other products; cursor directional keys must be used to enter the line number field. If COLS has been set to display column numbers and then the user changes to HEX

APS/SPF is fast and flexible, and is part of an integrated series of products for a programmer workstation.

mode, the COLS line is lost and the command must be reentered to recover the column number display. Also, in the TF n command, n represents the number of columns across that the text is to be flowed, rather than the number of the right column boundary for the flow. This is a subtle departure from established ISPF practice. Again, these departures from mainframe usage are specific only to APS/SPF.

A drawback to the use of virtual memory in APS/SPF is that when a work data set is being used, the exclude (X) line command is not operational. A bug is present in the overlay block command (OO); if a line is overlaid with a blank line, the software returns a single O in the number field of the line being overlaid, with a message signaling (incorrectly) that an overlay is still pend-

ing. If the use of text flow (TF) and justified text flow (TJ) is combined with an error in the use of a line command followed by the RESET command, the results are erratic and result in the insertion of unwanted blank lines.

APS/SPF offers very high speed performance, considerable flexibility, and integration as part of a complete programmer workstation package. It has a number of reliability quirks, however, and lacks certain ISPF features.

HCS Editor. Unlike the other three products, which can be characterized as more or less full-function ISPF, HCS Editor lacks a main menu, separate utilities functions, and separate screens for edit and browse. The function that allows the user to customize the system is not a main menu option as with the other products and mainframe ISPF, but instead is a program that is executed separately from DOS. These differences from ISPF, it could be argued, might account for its needing less memory than two of the other products. Since this product cannot exploit virtual memory techniques, it must try to keep main memory as free as possible to accommodate the edit file. These sacrifices in format and function may be of little consequence to the user who has not already grown accustomed to mainframe ISPF, but to the ISPF old-timer they can be jolting.

HCS Editor has simpler implementations of the display of free memory and customized color control than does SPF/PC. Its other simplifications of mainframe ISPF include toggles without explicit ON/OFF operands for the COLS and HEX commands.

Some of the most sophisticated features of ISPF are absent, such as the FIND Picture string argument, and the PREFIX, SUFFIX, and WORD parameters of the FIND function.

All line edit commands are implemented as single-letter commands. For example, T is used instead of TF for text flow. HCS Editor's tendency to scan for only the first letter entered as a line command therefore results in a Copy command, if COLS is mistakenly entered in the line command rather than in the primary command field.

If T stands for text flow, then text edit cannot be TE, but TEX instead. When TEX text entry mode is in operation, the scroll left and right functions are unavailable, although this is no serious handicap. A more serious problem is that the text flow command will sometimes flow the text out to the maximum line length of 254, even though the data entered were in an 80-column

"I Program In BetterBASIC And I Recommend It!"

"Lifeboat Associates," has expanded its philosophy of endorsing structured programming languages to include a truly superior product—BetterBASIC. More than just a BASIC, BetterBASIC offers use of the full memory of the computer, true procedures and functions, modularity and more. BetterBASIC has the advantages of the C language on which Lifeboat built its reputation and appeals to the wide audience of programmers who already program in BASIC. I liked BetterBASIC so much, I decided "Lifeboat" should publish it. I program in BetterBASIC and I recommend it."

Dr. Edward Currie, President—Lifeboat Assoc.—New York, NY

ACCESS FULL MEMORY—

BetterBASIC accesses the full memory of the computer enabling you to overcome Microsoft's 64K barrier.

INTERACTIVE

COMPILER—BetterBASIC compiles to an intermediate code giving you five to six times the speed of traditional BASICs. There is immediate feedback on line entry.

COMPATIBLE—Version 2.0 of BetterBASIC is GW-BASIC, PC-BASICA compatible when running on IBM

PCs. BetterBASIC is easy to learn because the syntax is the same.

STRUCTURE—Create well-organized programs using procedures and functions that are easily identified and understood.

NOT COPY PROTECTED—Install BetterBASIC on your hard disk. BetterBASIC is licensed to the programmer, so you can compute at work and at home using the same copy of BetterBASIC.

USER DEFINED KEYWORDS—The BetterBASIC language can be extended by adding your own procedures and functions to the language as keywords.

RUNTIME SYSTEM—Creates stand-alone EXE. files. Developers can distribute their programs written in BetterBASIC without royalties.



SAMPLE DISK—Contains a tutorial, a demo, and allows you to use an abbreviated form of BetterBASIC. It also contains a 60 page on-line mini manual.

AND MORE—Such as DOS and BIOS ROM calls, Chaining, Overlays, Local and Global Variables, Recursion—Graphics and Windows—You can define up to five windows. Optional 8087/80287 Math Chip Support.

LIBRARIES—Write reusable code.

TECHNICAL SUPPORT—

Available to all registered users.

BetterBASIC Runs on IBM PC, XT, AT and all IBM-compatibles. Ask your local dealer for BetterBASIC or call 1-800-225-5800.

In Canada call 416-469-5244. Also available for the Tandy 1000, 1200 and 3000 at Tandy/Radio Shack stores.

PRICES:

Better BASIC	\$199
8087/80287 Math Module	\$99
Runtime System	\$250
Sample Disk with Tutorial	\$10

Better
BASIC.

Because It's The Best.

CIRCLE NO. 195 ON READER SERVICE CARD

Summit Software Technology, Inc.™

106 Access Road, Norwood, MA 02062

MasterCard, Visa, Checks, Money Order, C.O.D. accepted and P.O. on approval.

BetterBASIC is a registered trademark of Summit Software Technology Inc.

IBM PC, XT, AT, are registered trademarks of International Business Machines Corp. Tandy is a registered trademark of Tandy Corp.
(If you're using BetterBASIC and would like to be featured in one of our ads, please write to the Director of Advertising at Summit.)

SPF EDITORS

COBOL file, so **Tn** must be used to control this function.

Several times, this product hung up and could be exited only by warm boot. On one occasion, when the product was brought back up after such a boot, the edit menu was filled with data from the file that had been under edit. The screen would accept no new commands, successive rebooting could not clear up the problem, and resolving it required reinstallation to the hard disk from the distribution diskette.

One particular advantage of HCS Editor is its ability to encrypt data. This feature is unique among the four products reviewed, and it is not a function offered by mainframe ISPF.

While HCS Editor is in some ways a stripped-down product, and still contains a number of irritating bugs, it could be worth its low price of \$49.95 to those who do not insist upon complete mainframe ISPF compatibility or IBM-class reliability.

micro/SPF. This product's strong suit is reliability. Many software developers' ideal is to make software bulletproof. Certainly it requires considerable effort to break or hang mainframe ISPF through the keyboard. While all four of these products are moderately reliable when directions are followed, micro/

SPF probably would hold up best to a monkey tapping on the keyboard.

PHASER also deserves credit for its professional documentation. Its manual is thorough, easy to read, and attractively formatted. A rugged keyboard template for the function keys is provided.

PHASER indicates that micro/SPF has been tested and found to be compatible with the following compilers: Micro Focus COBOL, REALIA COBOL, DRI PL/1, and DRI FORTRAN. Editor compatibility in this sense means that no control characters or "high-bit" information is added to an edit file, and that program source code edited with the editors will be cleanly compilable by the compatible compilers. These compatibility claims have not been independently confirmed by *PC Tech Journal*.

For those desiring mainframe communications in connection with ISPF edit work on the PC, two options are offered. Included in the price of micro/SPF is the Network Communications Facility (NCF). The required mainframe portion of NCF is available on magnetic tape upon request for no additional charge. PHASER'S Virtual Disk Access Method (VDAM) mainframe communications package, allowing TSO/ISPF emulation on the PC not only in its local environment but on the main-

frame as well (as a substitute for TSO) is considerably more expensive at \$4,950 for a five-node installation. Neither of these products was tested.

This is the only one of the four products that does not imitate ISPF's support of Partitioned Data Sets (PDSs) simply by prompting for DOS paths in place of PDS names on the edit menu. Instead, micro/SPF attempts to emulate the PDS concept fully by means of a catalog function that maintains a table of equivalences between PDSs and simple system-named files (of the form SPF34201.PSI). The statistics offered in the sorted lists of PDS members are more like mainframe TSO/ISPF, as well, in providing the length of the file in number of lines rather than in the number of bytes, as is the case with DOS. Both file size measures are thus available to the micro/SPF user.

The additional overhead to maintain and consult the catalog table seems inconsequential, and this approach is fine if the user will be accessing his files only through micro/SPF, but it makes DOS file names extremely cryptic. To be sure, existing, conventionally named files can be added to the micro/SPF catalog, but some may find this feature cumbersome in use.

Because micro/SPF does not initialize an edit profile for a given file based on its DOS extension (.COB, .BAS, .PAS, etc.), NUMBER ON COBOL (NUM ON COB) had to be entered at the beginning of each session involving a COBOL file. The BOUNDS parameter sometimes was initialized without a valid right bound. As a result, the command FIND ' ' ALL on a small file produced displayable data (although garbage) to the left of what should have been the left bound of the data (column 1), and even the redoubtable RESET command was unable to correct the problem. This was the only reliability problem encountered with the micro/SPF product.

As the tables show, a few ISPF features, including text entry (TE) and text flow (TF), are absent from this product. Nevertheless, the features present are in general so cleanly implemented that for users requiring high reliability, this product is well worth the \$175 price. **SPF/PC.** This is a sound product that offered the fastest performance on the PC/XT when doing such normal tasks as repeatedly finding or changing a string occurring only a few times in a file. Its performance bogged down only on string-crunching benchmark activities that ordinarily would be performed by custom string processing programs any-

PC TOOLS

Put all the popular features of the NORTON UTILITIES* together with a powerful DOS interface. Then make them **resident** like SIDEKICK** and what do you have? PC TOOLS—the only product that lets you execute virtually any DOS command from within any other running program! Here's how you might use it:

- **UNDELETE** an accidentally erased file while using your word processor!
- **FORMAT** a data disk without leaving your spreadsheet!
- **COPY** files from one subdirectory to another within your communications program!
- **LOOK** at another file (and even edit it) from your graphics package!
- **SEARCH** for any file name or text within a file without leaving your data base manager!
- **PRINT** a file (as text or hex and ASCII) at any time!

PC TOOLS works on most IBM compatibles, requires 192K, 256K to use the memory resident feature.

PC TOOLS is unprotected, of course, to work great from your hard disk!

CENTRAL POINT
Software, Inc.

9700 SW Capitol Hwy., #100
Portland, OR 97219

503/244-5782

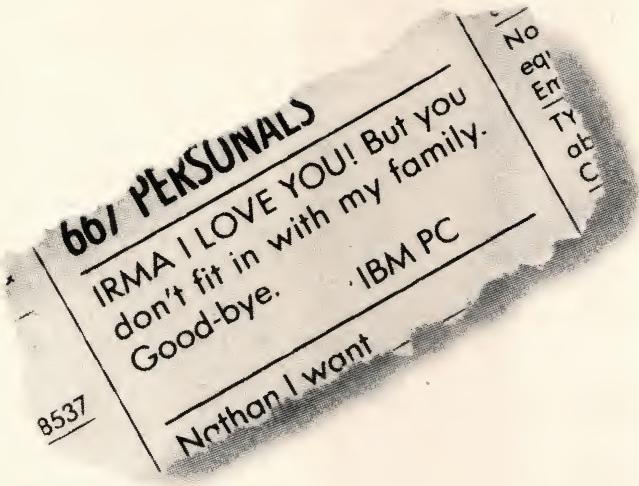
M-F, 8-5:30, W. Coast Time
  CHECK, COD WELCOME
(Prepayment Required)

\$39.95

plus \$3 s/h (\$8 overseas)

*Norton Utilities is a registered trademark of Peter Norton
**Sidekick is a registered trademark of Borland International

CIRCLE NO. 121 ON READER SERVICE CARD



Why say good-bye to your favorite IRMA™ applications when *Attachmate's* 3-N-1 Adapter runs both IRMA programs and IBM®'s new family of software.

The Attachmate 3-N-1 is a single-slot adapter for your IBM PC/XT/AT's or compatibles that functions as three: DCA's *IRMA Board*, IBM's 3278/79 Coax Adapter and a Multi-Session 3270 PC.

Continue using all your familiar IRMA programs.

Begin using all the new IBM programs like PSPC, PC Bond and DISOSS.

Take advantage of IBM 3270 PC functions such as DFT, windows, file transfer, API and printer emulation with the included Attachmate software.

Discover the best of all worlds, call:

1-800-426-6283

Attach mate

Attachmate Corporation
3241 118th S.E. Bellevue, WA 98005
206-644-4010

IRMA is a trademark of DCA Corporation.
IBM is a registered trademark of International Business Machines.

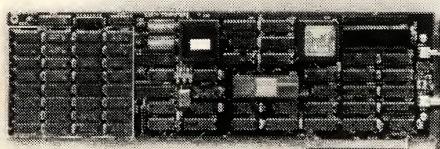
CIRCLE NO. 218 ON READER SERVICE CARD

LOOKING FOR AT PREFORMANCE FROM YOUR PC?



EARTH HAS IT FOR LESS THAN \$1,000!

YOUR SEARCH IS OVER!! EARTH COMPUTERS' exciting new high-speed, 80286 accelerator card, **TurboACCEL-286™**, is just what you've been looking for. The **TurboACCEL-286** will boost your PC performance up to **Five times...its completely software transparent...and its only \$995!** **TurboACCEL-286** will function with most operating systems and application programs (unlike other so-called accelerator boards).



The **TurboACCEL-286** features a high-speed, 8MHz, 80286 processor, 512Kbytes of RAM (expandable to 1Mbytes), a switch for 8088 operation, and facilities for an 80287 math coprocessor. It occupies one expansion slot, is completely compatible with most PCs and is software transparent. End your search for AT performance. Order the **TurboACCEL-286** today! Call or write:



EARTH COMPUTERS

P.O. Box 8067, Fountain Valley, CA 92728
TELEX: 910 997 6120 EARTH FV

(714) 964-5784

Ask about EARTH COMPUTERS' other fine PC and S-100 compatible products.

CIRCLE NO. 212 ON READER SERVICE CARD

138

SPF EDITORS

way. As a further confirmation of its efficiency, SPF/PC's memory requirements are the lowest of the three full-function products reviewed. (HCS Editor is not close enough to mainframe ISPF to be considered full function.)

SPF/PC includes a communications package at no additional charge; however, this package is for communications with other PCs, not with mainframes. This feature was not tested in the course of this review.

This product offers some fine convenience features, such as a precise display of the amount of free main memory, and displays of the data set name, the range of columns currently displayed, and the current line and column coordinates of the cursor. None of the other products offers all of these at once. The system can be customized and tuned extensively, including alteration of screen colors, turning on and off expansion and compression of data blanks using tabs, and so on.

On the down side, the profile command displays one nonexistent toggle: the mainframe AUTOLIST function. As with APS/SPF, this is an attempt to mimic mainframe ISPF editor screens, but displaying toggles that are not supported by the product is misleading. Also, the CAPS ON function is not implemented as it is on mainframe ISPF, by converting lowercase input to uppercase when Enter is pressed; rather, CAPS ON works like CapsLock. The text flow (TF) command shows evidence of some subtle bugs; on one occasion, when strings of characters were trimmed off the ends of several lines in between two uses of the TF command, the product hung up, and eventually required a warm boot to recover.

More seriously, an attempt to alter data on the HEX display can cause the SPF/PC to hang up, making it necessary to warm or even cold boot the computer to get out of trouble. This is particularly the case with the HEX EBCDIC display. HEX EBCDIC should be used with caution, if at all.

While most of the mainframe ISPF features are available in this product, it is important to note that the extraordinarily powerful Find Picture function is not present; neither is the HEX DATA display option.

To be sure, this package, like the other products, is missing a few of the features implemented on mainframe ISPF, and it also exhibits occasional lapses in reliability. But its overall reliability and benchmark performance in routine word processing tasks do justify its high-end price of \$195.

SUBTLETIES

The accompanying tables compare the subtle differences among these products; no one editor will be best for everyone. First, functionality: because different mainframe ISPF features are missing from each product, knowing the need for particular features is paramount. If reliability is crucial, micro/SPF is a good choice with SPF/PC nearly equal; a choice between these two might depend upon the differences in the ISPF features that each offers. If the product must be integrated with a full-function programmer's workstation, APS/SPF could be the best choice, although the others may be compatible with software that provides similar support. Finally, if price is critical and the user is not concerned that the product be a mirror image of mainframe ISPF, then consider HCS Editor at \$49.95.

A final note: Each product went through several releases while this review was in preparation, and further releases are to be expected before the article is printed. Many of the shortcomings noted have been brought to the vendors' attention; any or all could be addressed in future releases.

APS/SPF 2.2: \$145.00

*Arrix Logic Systems, Inc.
4002 Sheppard Avenue E
Suite 514*

*Aigincourt, Ontario, M1S 1S6 Canada
416/292-6426*

CIRCLE 346 ON READER SERVICE CARD

HCS Editor (10/19/85): \$49.95

*Heuristic Computer Systems
15733 SE 175th Place
Renton, WA 98055
206/228-6543*

CIRCLE 347 ON READER SERVICE CARD

micro/SPF 3.2: \$175.00

*PHASER Systems, Inc.
24 California Street
San Francisco, CA 94111
415/434-3990*

CIRCLE 348 ON READER SERVICE CARD

SPF/PC 1.82: \$195.00

*Command Technology Corporation
1900 Mountain Blvd.
Oakland, CA 94611
415/239-3530*

CIRCLE 349 ON READER SERVICE CARD

Rudy S. Spraycar is assistant superintendent for data processing training and education with USF&G Insurance in Baltimore. His programming background includes 10 years' experience in using IBM's TSO Edit facility and ISPF full-screen editor.

THE PROGRAMMER'S SHOP™

helps save time, money and cut frustrations. Compare, evaluate, and find products.

SERVICES

- Programmer's Referral List
- Dealer's Inquire
- Compare Products
- Newsletter
- Help find a Publisher
- Rush Order
- Evaluation Literature FREE
- Over 700 products
- BULLETIN BOARD - 7PM to 7AM 617-826-4086

AI - Expert System Dev't

Arity System - incorporate with C programs, rule & inheritance PC \$295
 1st Class - by example, interfaces \$250
 ExpertEASE - Develop by describing examples of how you decide. PC Call
 EXSYS - Thorough, improved. Debug, report gen. PC \$349
 INSIGHT1 - Probabilities, required thresholds, menus, fast (\$79). 2 adds backward, forward, partitions, dB2, lang, access. PC \$399
 Others: APES (\$359), Advisor (\$949), ES Construction (\$100), ESP (\$845), Experteach (\$399), Expert Choice (\$449)

AI - LISP

List Our
 GC LISP - "Common", rich. Interpreter - Interactive Tutorial \$495 Call
 LARGE Model - 2 to 15 meg.
 Compiler and Interp. \$1190 Call
 TLC LISP - "LISP-Machine" - like, all RAM, classes, turtle graphics, 8087, compiler. CPM-86, MS \$225
 WALTZ LISP - "FRANZ LISP" - like, big numbs, debug, CPM-80 MS \$149
 Others: IQ LISP (\$155), BYSO (\$125), MuLISP-86 (\$199)

AI - PROLOG

ARITY Standard - full, 4 Meg PC \$ 95
 Interpreter - debug, C, ASM PC \$ 350
 COMPILER/Interpreter - EXE PC \$ 795
 With Exp Sys, Screen - KIT PC \$1250
 MicroProlog - enhanced \$ 229
 MProlog - Improved. Faster PC \$ 725
 Professional MicroProlog MS \$ 359
 TransPROLOG - Learn Fast, Standard, tutorials, samples MS Call
 Others: Prolog-1 (\$359), Prolog-2 (\$1895).

AI - OTHER

METHODS - SMALLTALK has objects, windows, more PC \$239
 QNIAL - Combines APL with LISP Library of sample programs included. Source or binary. PC \$375
 SNOBOL4 + -great for strings, MS \$ 85

FEATURE

TransLisp - "Common subset, tutorial, editor, PP, trace. Best to learn. 20 Demos All MS Only \$ 75

Free Literature - Compare Products

Evaluate products. Compare competitors. Learn about new alternatives. One free call brings information on just about any programming need. Ask for any "Packer" or Addon Packet AI ADA. Modula BASIC C COBOL Editors FORTH FORTRAN PASCAL UNIX/PC or Debuggers, Linkers

RECENT DISCOVERY

Dan Bricklin's Demo Program - Prototype quickly, with realism. User feedback without programming. All 250 ASC characters plus attributes. Subsetting, building blocks, macros, thorough. PC \$ 75

BASIC

ACTIVE TRACE, DEBUGGER - BASICA, MBASIC, interactive, well liked	MS \$ 79
BASIC DEVELOPMENT SYSTEM - (BDS) for BASICA; Adds Renum, crossref, compress.	PC \$115
BetterBASIC all RAM, modules. structure. BASICA - like	PC \$169
8087 Math Support	\$ 89
Run-time module	\$459
CADSAM FILE SYSTEM - full ISAM in MBASIC source.	MS \$ 75
CB-86 - DRI CPM86,	MS \$419
Data Manager - full source	MS \$325
InfoREPORTER - multiple	PC \$115
PC/BASIC for Macintosh - by Pteradactyl. Compiles IBM BASICA, and MS BASIC for MAC syntax.	\$250
Prof. Basic - Interactive, debug	PC \$ 89
8087 Math Support	\$ 47
QuickBASIC by Microsoft - Compiles full syntax of IBM BASICA, 640K,	PC \$ 85
TRUE Basic - ANSI	PC \$109
Run-time Module	PC \$459

COBOL

Macintosh COBOL - Full	MAC \$459
MBP - Lev II, native	MS \$885
MicroFocus Prof. - full	PC Call
Microsoft Version II - upgraded. Full	
Lev. II, native, screens.	MS \$500
Realia - very fast	MS Call
Ryan McFarland - portable	MS \$695

Editors for Programming

BRIEF Programmer's Editor - undo, windows, reconfigure	PC Call
C Screen with source	80/86 \$ 75
EMACS by UniPress - powerful, multifile, windows, DOS, MLISP, programming.	Source: \$949 \$299
Entry Systems for C	PC \$325
Epsilon - like EMACS, full C-like lang.	PC \$169
FirsTime by Spruce - Improve productivity. Syntax directed for Turbo (\$69), Pascal (\$229), or C (\$239)	
Kedit - like XEDIT	PC \$115
PMATE - power, multitask	80/86 \$159
VEDIT - well liked, macros, buffers, CPM-80-86.	MS PC \$119
XTC - multitasking	PC \$ 95

Ask about ATARI ST, Amiga

C Language - Compilers

BDS C - solid value, fast	CPM80 \$125
C86 by CI - 8087, reliable	MS Call
Consulair Mac C w/toolkit	MAC \$299
ECO C/88	MS \$ 59
Lattice C - from Lifeboat	MS \$289
Lattice C - from Lattice	MS \$339
Mark Williams - debugger	MS \$379
Megamax - tight, full	ATARI/ST \$179
Microsoft C 3.0 - new,	MS \$259
Q/C 88 by Code Works - Compiler source, decent code, cross	MS \$125
Wizard C - Lattice C compatible, full sys. III, lint, fast.	MS \$379

C Language - Interpreters

C-terp by Gimpel - full K & R., OBJ and ASM, large progs.	MS \$249
INSTANT C - Source debug, Edit to Run-3 seconds	MS \$399
Interactive C by IMPACC Associates. Interpreter, editor, source debugger, profiler.	PC \$395
Introducing C - Interactive C to learn fast, tutorial.	PC \$115
Professional Run/C has C plus ability to create add-in libraries, (Lattice C compatible) and load/unload them.	MS \$199
Run/C - improved	MS \$109

C Libraries - General

Blaise C Tools 1 (\$109), C Tools 2	PC \$ 89
C Food by Lattice - ask for source	PC \$119
C*LIB by Vance	PC \$129
C Utilities by Essential - Comprehensive screen graphics, strings, file handling, memory mgmt. Source.	MS \$139
Entelekon C Function Library	PC \$119
Entelekon C Windows	PC \$119
Entelekon Superfonts for C	PC \$ 45
Greenleaf Functions - portable, ASM	\$139
Polytron - for Lattice, ASM source	\$ 99
Software Horizons - Pack 1	\$129

C Libraries - Communications

Asynch by Blaise	PC \$149
Greenleaf - full, fast	PC \$139
Software Horizons - pack 3	PC \$119

C Libraries - Files

FILES: C Index by Trio - full B + Tree, vary length field, multi compiler /File is object only	MS \$ 89
/Pro is partial source	MS \$179
/Plus is full source	MS \$349
CBTREE - multiuser record locking, sequential, source, no royalties	MS \$ 99

THE PROGRAMMER'S SHOP™

provides complete information, advice, guarantees and every product for Microcomputer Programming.

We support MSDOS (not just compatibles)
PCDOS, Xenix-86, CPM-80, Macintosh,
Atari ST, and Amiga.

C Libraries - Files Cont

dbVISTA-full indexing, plus optional
record types, pointers, Network.
Object only - MS C, LAT, C86 \$179
Source - Single user MS \$459
Source - Multiuser MS \$929

C Support - Systems

Basic C Library by C Source PC \$139
C Debug - Source debuggers - by
Complete Soft (\$269), MSD (\$149).
C Sharp - well supported, Source,
realtime, tasks MS \$600
C ToolSet - DIFF, xref, source MS \$135
Lattice Text Utilities MS \$105
The HAMMER by OES Systems PC \$179
H.E.L.P. By Everest Solutions PC \$329
Security LIB - add encrypt to MS C,
C86 programs. Source \$250 PC \$125

C - Screens, Windows, Graphics

Curses by Lattice PC \$110
CView - input, validate PC \$195
C Power Windows PC \$130
Databurst - C or Basic PC \$215
GraphiC - source in C MS \$219
Topview Toolbasket by Lattice PC \$219
View Manager for C by Blaise PC \$219
Windows for C - fast PC \$149
Windows for Data - validation PC \$209

DEBUGGERS

Advanced Trace-86 by Morgan
Modify code on fly. PC \$149
CODESMITH - visual, modify
and rewrite Assembler PC \$119
Periscope I - own 16K PC \$269
Periscope II - symbolic, "Reset Box,"
2 Screen PC \$119
Pfix-86 Plus Symbolic Debugger by
Phoenix - windows PC \$289
SOURCE PROBE by Atron for
Lattice, MS C, Pascal, Windows
single step, 2 screen, log file. PC \$395

Feature

Panel Screen Generator - Create
screen with editor, generates
code. Full data validation,
windows, no royalties. Specify
Lattice, MSC, C86, MS Fortran
or PASCAL MS \$239

SERVICE: FREE NEWSLETTER

Software development and AI on micros: trends, forecasts, controversies, innovations, and techniques. Plus an announcement of 80 NEW tools. CALL for the "Newsletter Packet."

RECENT DISCOVERY

dBrief, the dBASE Assistant -
optional syntax directed editing,
screen gen, graphics, speed coding.
dBASE II, III, Clipper. PC \$ 95

Fortran & Supporting

Forlib + by Alpha - graph, comm. PC \$ 59
Fortran>> C-FORTRIX creates
maintainable translations. MS \$995
MACFortran by Microsoft-full '77 MAC \$239
MS Fortran MS \$239
No Limit - Fortran Scientific PC \$129
PolyFortran - xref, pp, screen PC \$149
Prospero - '66, reentrant MS \$390
RM Fortran-enhanced "IBM FTN" MS \$429
Scientific Subroutines - Matrix MS \$149
Statistician by Alpha MS \$269
Strings and Things-register, shell MS \$ 59

Multilanguage Support

BTRIEVE ISAM MS \$199
CODESIFTER - Execution PRO-
FILER. Spot bottlenecks. Symbolic.
automatic. PC \$109
MultiHALO Graphics-Multiple video
boards, printer, rich. Animation,
engineering, business.
ANY MS language, lattice, C86 PC \$189
For Turbo \$ 89

PLINK 86 - a program-independent
overlay linker to 32 levels for all MS
languages, C86 and Lattice. AMS \$299
Pfinish Performance Analyzer
by Phoenix PC \$219
Profiler by DWB Associates PC \$109
PS MAKÉ by UniPress MS \$ 79
Screen Sculptor - slick, thorough,
fast, BASIC, PASCAL. PC \$109
ZAP Communications - VT 100, TEK
4010 emulation, full xfer. PC \$ 65

TURBO PASCAL and SUPPORT

BORLAND: Turbo 3.0 \$ 49
3.0 with 8087 or BCD \$ 79
3.0 with 8087 and BCD \$ 85
Turbo Graphix - graphs, windows \$ 39
Turbo Toolbox or Editor \$ 55
Turbo Tutor \$ 29
TURBO . . . Asynch by Blaise, full \$ 89
MetaWindow by Metagraphics \$ 49
Power Tools by Blaise - library \$ 89
Power Utilities - profiler, pp \$ 89
Professional - interrupts, macros, \$ 70
OTHERS: Screen Sculptor (\$99),
Pascal Pac (\$100), Tidy (\$45),
Multi Halo (\$89).

OTHER LANGUAGES

APL + PLUS/PC \$469
ED/ASM-86 by Oliver Computing.
Integrated editor/assembler/debugger
w/8087 support. MS \$ 95
HS/FORTH - '79 & '83 Standards, full
RAM, ASM, BIOS, interrupts, graph,
multi-task, optimizer MS \$250
MacASM - fast \$99
MasterForth by MicroMotion - floating
point and relocator extensions
available: Call MAC or PC \$125
MS MASM - faster MS \$109
Mystic Pascal - fast MS \$ 64
Paragon PASCAL - for performance:
extensions like "packages", "Iterators"
5 memory models. 64 bit 8087 strings.
Space vs. speed MS \$895
PASM - by Phoenix MS \$239
PL1-86 - Ansi subset \$499
Prospero Pascal - full ISO + MS \$390
Turbo ED/ASM PC \$ 85

XENIX-86 & SUPPORT

Basic - by Microsoft \$295
Cobol - by Microsoft \$895
Fortran - by Microsoft \$429
Xenix Complete Development System Call

OTHER PRODUCTS

CPRINT - by ENSCO MS \$ 50
dBASE to C Translator: dBx -
no royalties, addon ISAM,
Library Pioneer it MS \$ 350
Source \$1000
HTest/H Format - XT Fix PC \$119
Microsoft Windows PC \$ 75
Opt Tech Sort - sort, merge MS \$ 85
Polymake - Directly execute or GEN a
batch file, batch, interactive. MS \$129
Qwik Net - critical path, resources,
thorough; usable. Source \$995 PC \$299
SoftEst - Software Estimating and
reporting. Pioneer it. MS \$350
Texsys - control source MS \$ 89
Visual Computer: 8088 - Simulates
demos or any .exe. Com. Debugger.
350 pg. tutorial PC \$ 59

Note: All prices subject to change without notice.
Mention this ad. Some prices are specials. Ask about
COD and POs. All formats available.

Call for a catalog, literature, advice and service you can trust

NEW HOURS

8:30 AM - 8:00 PM EST

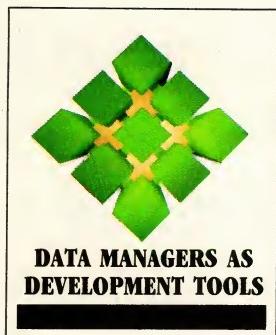
800-421-8006

THE PROGRAMMER'S SHOP™

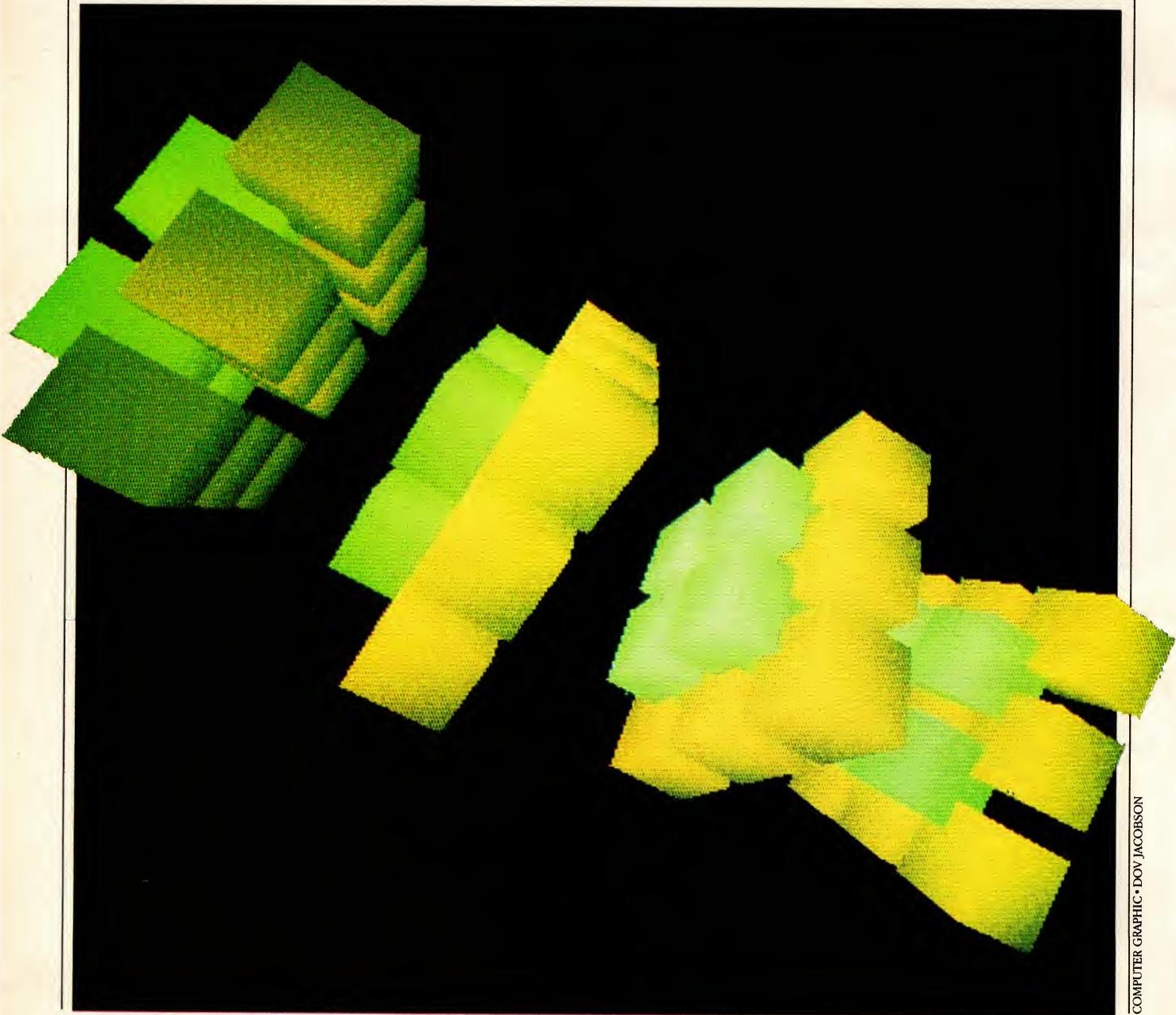
128-P Rockland Street, Hanover, MA 02339
Mass: 800-442-8070 or 617-826-7531 186

"I would like to mention that I appreciate
the way that the Programmer's Shop does
business. It is indeed refreshing to be able
to call and get answers that you can trust in,
to questions on various products."

Donald E. Winters
MIS Software Development Inc.



A Data Manager for
**Transaction
Processing**



COMPUTER GRAPHIC • DOV JACOBSON

Applications developed with PROGRESS possess features—crash recovery, portability, transaction processing, and a sensible query facility—that developers would have trouble delivering otherwise.

MARK KARAMAN

Data Language Corporation was founded in 1981 by veterans of the mainframe environment with extensive backgrounds in data management and fourth generation languages. Having made significant technical contributions to products such as the MIMS fourth generation language and database by Mitrol and the Model 204 database by Computer Corporation of America, developers at Data Language set out to create an applications development system for UNIX supermicros. In August 1984 Data Language introduced the first UNIX implementation of PROGRESS, a multiuser database and fourth generation language integrated within a development environment that includes an editor, data dictionary, compiler, and security facilities.

A reflection of its origins, PROGRESS possesses many mainframe-like features, including transaction processing, automatic crash recovery, and security. Transaction processing is a concept new to many microcomputer applications developers, but its benefits cannot be overstated. When combined with automatic crash recovery, it gives developers the ability to deliver fault-tolerant applications without programming somersaults. PROGRESS contains many such intrinsic qualities that add significant value to applications without requiring additional coding.

PROGRESS has received significant acclaim in the UNIX marketplace and currently runs on dozens of multiuser systems including the DEC VAX 11/780 and AT&T 3B5. A DOS version was first released in March 1985. This single-user PROGRESS runs under DOS 2.1 or greater on an IBM PC, PC/XT, or PC/AT. PROGRESS requires at least 512KB of RAM and a hard disk to operate and with "the works" occupies at least 2MB of

disk storage. Pricing for the gamut of machines to which PROGRESS has been ported ranges from \$695 for the PC to \$19,500 for the DEC VAX 11/780, as the accompanying sidebar shows.

PROGRESS is written in both C and assembly language. Data Language's primary reason for using C was portability. Data Language provides source-code compatibility across all systems as well as a uniform integrated applications environment. It is 100-percent compatible with Borland's SideKick.

Last year, Applied Data Research (ADR), a leading vendor of mainframe database and fourth generation language software, reached a \$2 million nonexclusive license agreement to develop products using PROGRESS technology. This was a significant endorsement of the product's database and applications development environment.

This eighth in a series of data manager reviews explores PROGRESS 2.3d. Using *PC Tech Journal's* sample application as a springboard, the information and analysis that follows form a basis for direct comparison with other applications development systems in this series. (For a description of the sample application, benchmarks, and review methodology, see "Sample Application Specifications," August 1985, p. 48. The article is also available for downloading on PCTECHline, 301/576-PCTJ.)

DATABASE DESIGN

PROGRESS uses the relational data model, which results in a very flexible database environment where relationships between files can be created freely using common data fields and do not have to be specified in advance.

A single PROGRESS database can contain as many as 1,023 files and 1,023 indexes with a minimum of one index

per file, but no maximum number of indexes per file. Each index can contain as many as 10 fields but cannot exceed 127 bytes in length. Character fields are variable length and can be up to 255 characters long. Record size is limited to 2,000 bytes and presents the only limit on the number of fields per record. The number of files and records that can be active at any one time is set by record buffer capacity, which can be defined from 1KB to 31KB in size.

All fields of a record are of variable length. They can be character, date, integer, decimal, or logical with arrays supported for all types. Table 1 gives the range of values for each data type as well as the amount of disk space each type uses within the record.

Some interesting implications to software developers are also revealed in table 1. With PROGRESS a developer can specify large comment fields, but the only storage space consumed is that needed to store the actual data. Unlike dbASE III memo fields, PROGRESS variable length fields can participate in all logical comparisons, substring, string search, and concatenation operations.

To find a particular record within a file, PROGRESS maintains a list of record identification (RECID) numbers paired with offset values. These RECDs are the lowest access PROGRESS allows the developer and are most often used to pass explicit record references between procedures. PROGRESS performs indexing by maintaining lists of RECDs paired with key values in b-trees.

TRANSACTION PROCESSING

Perhaps PROGRESS's most significant contribution is a comprehensive transaction processing implementation. All processing related to a single transaction is described within a transaction block. The

PROGRESS

language syntax for doing this is described later. As each record in the database is modified, its previous value is written to a *before image* (.BI) file. If processing of the entire block is not completed—because it was aborted by the user, a program undo request, or a system crash—information in the .BI file is called upon to restore the database to its pretransaction state.

Power failures and user reboots have long been the bane of complex applications. Often resulting in partially updated indexes or working files out of phase with global records (highest account number, year-to-date totals, etc...), such exits leave insidious errors in an application's data files. Any abnormal termination of a PROGRESS application will result in a message at restart:

**** The last session was abnormally terminated.**

**** Your database is being repaired**

and, short of any massive file damage, this message appears:

**** Your database has been repaired, you may have to redo the last task.**

The data integrity feature can be overridden with a -i start-up parameter. This is recommended for initial loading of data or for massive file updates (such as year-end processing of a large multi-user application) in which the extra disk accesses from writing to the before image file might slow down the process considerably. Naturally, the entire database should be backed up before invoking PROGRESS with the -i parameter. In the XENIX version of PROGRESS a single-user start-up flag is also available. This prevents processing hang-ups caused by record lock-outs and speeds massive file updates when used in conjunction with the -i start-up option.

No extra programming is required to take advantage of the transaction processing feature. On the contrary, adjustments may be required to reduce the scope of a transaction. Default transaction blocks left unmodified on long loops may create a very large .BI file.

Besides maintaining the overall integrity of a database, transaction processing is useful in implementing electronic forms. Automation of forms often involves several relational files, calculations, and multiple table look-ups. Typically, many records and memory variables are changed in the process, so an applications developer cannot easily give the user an instant exit capability. Placing the form entry program within a transaction block, however, is all that is required in PROGRESS. If the Escape key

TABLE 1: Field Types and Storage Requirements

DATA TYPE	VALUES	STORAGE (in bytes)
Character	1 to 255 characters	1 + number of characters, excluding trailing blanks. If string is greater than 240 characters, add 2.
Date	1/1/32768 B.C. to 12/31/32767 A.D.	3
Decimal	50 digits with up to 10 decimal places	zero: 1 nonzero: 2 + (number of significant digits + 1) / 2
Integer	-2,147,483,648 to 2,147,483,647	Up to 0: +127: +32,767: +24,000,000: +2 billion: 1 2 3 4 5
Logical	True or False	True False 2 1

All fields of a record are of variable length and can be character, date, integer, decimal, or logical, with arrays supported for all types. Large comment fields can be specified without consuming the maximum storage these fields could represent.

is pressed anytime within the form entry transaction block, all changes to data files or memory variables are automatically undone. With a little extra effort, the developer can create PROGRESS applications in which the Escape key always brings the user gracefully back to a menu or logical application juncture.

DICTIONARY

The dictionary is accessed from the PROGRESS editor by way of the help facility. Function key F2, pressed while editing, invokes the help menu shown in photo 1. From this multipurpose menu the user is able to enter the dictionary as well as gather additional information on recent error messages, command syntax, and the editor. When the user is finished with the help menu, the program returns to its location before the menu was invoked.

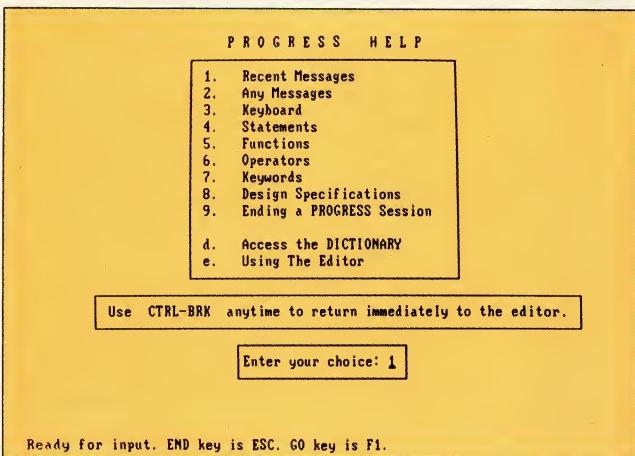
PROGRESS performs all dictionary functions, including displaying and changing data definitions, printing a dictionary report, loading and dumping of data files, and modifying data security. The dictionary is useful for such mundane tasks as verifying a file's field names, but it has a greater value when used in conjunction with its dynamic nature. Because fields are stored with variable lengths, an application's file definitions, fields, and indexes can be added, renamed, deleted, or modified without dumping and reloading data. The dictionary protects primary indexes or their component fields from being

accidentally deleted. Before the primary index can be deleted a new index must be declared primary. Additionally, PROGRESS automatically checks shortened field definitions against the database to avoid inadvertent truncation of data. If truncation is detected, all field update requests made in the same session are undone. This overreaction in error handling requires the remaining valid field changes of an editing session to be re-entered. However, in most cases these safeguards are unimposing.

The main PROGRESS dictionary screen reveals four options: display/change data definitions, print data dictionary reports, load/dump data files, and change/query data security. The first of these options is selected when the user is designing an application. It is used to create, delete, or rename files, define their fields, and specify indexes. Simply entering an undefined file name generates a PROGRESS prompt asking if a new file is to be created. PROGRESS then adds an empty file to the dictionary and proceeds to the field and index definition menu. This second menu contains file delete, rename, and copy facilities and an option to undo changes to a file's definitions.

Nine parameters define a field and control its properties, such as type, display format, alternate label, and whether it is an array. Because the developer can make changes to these definitions freely, final adjustments in field width or labeling are simplified. As was

PHOTO 1: The Help Menu



Ready for input. END key is ESC. GO key is F1.

Besides allowing the developer to get more information on recent error messages, command syntax, and using the editor, the help menu also allows entry to the dictionary.

noted above, an application's field definitions can be added or deleted without reloading the data files.

A field name can be 12 characters long and must start with an alphabetic character. If a field name is unique to the database, then use of that name is an unambiguous reference to that file. In the sample application, Listing is a field name that belongs exclusively to the Article file. Using Listing in a PROGRESS program is an absolute reference to Article.Listing. Volume and Number are fields in both the Article and Issue files, however. If they are used within a block in which both files are active, they must be differentiated: Article.Volume and Issue.Volume. The PROGRESS compiler reports such ambiguities automatically, which are corrected by renaming one field or prefixing the field's name with the file name.

With a little care in naming fields, most file relationships can be reduced to the more compact OF operator. File relationships conventionally specified by Boolean expressions such as

FOR EACH article

```
WHERE Issue.Volume = Article.Volume
AND   Issue.Number = Article.Number;
```

are more simply expressed as

FOR EACH Article OF Issue:

PROGRESS can use the OF operator on any two files with related fields that share the same name.

A file is unlimited in the number of fields it may contain. Any number can be defined up to a maximum record size of 2,000 bytes. If this limit is reached, files can be split and related one-to-one using the OF operator.

PHOTO 2: Displaying Data

The screenshot shows four examples of the DISPLAY command output:

- DISPLAY Issue.**: Shows a table with columns: Volume, Number, Deadline, Month, Year. One row is shown: 3 9 06/15/85 September 1985.
- DISPLAY Issue with no box.**: Shows a table with columns: Volume, Number, Deadline, Month, Year. One row is shown: 3 9 06/15/85 September 1985.
- DISPLAY Issue with no labels.**: Shows a table with columns: Volume, Number, Deadline, Month, Year. One row is shown: 3 9 06/15/85 September 1985.
- DISPLAY Issue with 1 column.**: Shows a single row of data: Volume: 3 Number: 9 Deadline: 06/15/85 Month: September Year: 1985.

Procedure complete. Press space bar to continue.

Using the dictionary definitions, DISPLAY, with its various parameters, can determine field names, labels, display format, and the order in which fields are to be displayed.

After a field is named, the user specifies its data type. Character, integer, decimal, and logical types are valid. Because character field lengths are variable, the field definition simply specifies maximum display length. Integers are suitable for all whole numbers from -2,147,483,648 to 2,147,483,647, while decimals can have 50 digits with up to 10 decimal digits. If a field is decimal, the developer is prompted for the number of digits to the right of the decimal point. Logical fields can be assigned values other than yes/no or true/false. This permits such pairings as arrival/departure or shipped/not-shipped.

Default output of field value can be controlled using the Format field definition entry. Numeric values can be displayed with or without leading zeros, marked with units such as \$, and punctuated by commas. Character field formats are limited to defining the displayed field length. This means that PROGRESS has no straightforward way to include characters that are not part of the field, such as the dashes in a Social Security Number (xxx-xx-xxxx) or the parentheses around the area code of a phone number.

PROGRESS programs do not have to specify field labels each time they display fields. The compiler looks to the label description or, if a label is not specified, the field name itself for labeling information. Invalid field names such as key words can be used to label fields on a display. For example,

Field-Name: Todays-date

Label: Date

labels all prompts and displays of Todays-date field with Date. Date could

not have been used as a field name because it is also a function name that returns the system date.

Initial (or default) values can be defined for each field. When a record is created these default values are automatically assigned, but they can be overridden during data entry. Providing defaults for fields such as State or City can speed data entry considerably in local or metropolitan operations.

A **Mandatory** descriptor can specify fields that must receive data. Before a user can complete data entry, all such Mandatory fields must be entered.

The **Order** value determines the order in which the fields are displayed. Each field is automatically assigned a multiple of 10 as its Order. A field can be inserted between other fields by giving it an Order between the values of the two fields, in much the same way that lines are inserted into a BASIC program. A field that has an Order of 25, for example, would be placed between fields of Order 20 and 30. In *PC Tech Journal's* sample application, this feature was used to insert a second address line. PROGRESS does not provide a facility that automatically renames a record's Order sequence.

Any field can be transformed into an array by specifying an **Extent** (the maximum number of elements) greater than zero. Arrays have a traditional syntax **field-name[n]**, where *n* is the element number. Array elements behave like any other field of their type. Array fields cannot, however, be indexed. Segments of an array can be specified using the syntax **field-name[n for m]**, which indicates a range of *m* elements starting from the *n*th element.

Instant-C™ The Fastest Interpreter for C

Runs your programs 50 to 500 times faster than any other C language interpreter.

Any C interpreter can save you compile and link time when developing your programs. But only **Instant-C** saves your time by running your program at compiled-code speed.

Fastest Development. A program that runs in one second when compiled with an optimizing compiler runs in two or three seconds with **Instant-C**. Other interpreters will run the same program in two minutes. Or even ten minutes. Don't trade slow compiling and linking for slow testing and debugging. Only **Instant-C** will let you edit, test, and debug at the fastest possible speeds.

Fastest Testing. **Instant-C** immediately executes any C expression, statement, or function call, and display the results. Learn C, or test your programs faster than ever before.

Fastest Debugging. **Instant-C** gives you the best source-level debugger for C. Single-step by source statement, or set any number of conditional breakpoints throughout your program. Errors always show the source statements involved. Once you find the problem, test the correction in seconds.

Fastest Programming. **Instant-C** can directly generate executable files, supports full K & R standard C, comes with complete library source, and works under PC-DOS, MS-DOS, or CP/M-86. **Instant-C** gives you working, well-tested programs faster than any other programming tool. Satisfaction guaranteed, or your money back in first 31 days. **Instant-C** is \$495.

Rational
Systems, Inc.

P.O. Box 480
Natick, MA 01760
(617) 653-6194

PROGRESS

PROGRESS 2.3d has no field descriptor for providing context-sensitive help, although Data Language plans to include it in version 3. Additional validation capabilities will include range checking and table look-ups.

Security in PROGRESS is handled from the security menu where individual users can be granted or denied permission to see or change information. Each field has its own _Can-Read and _Can-Write permissions. Multiuser implementations of PROGRESS have flexible security based upon the UNIX user ID. Under DOS, however, PROGRESS has no log-on facility to identify a user other than root. Security in single-user PROGRESS must be coded into the application. A log-on front end, such as provided in R:Base, is not available.

All PROGRESS databases are created from a database called EMPTY.DB or copied from a live database. The first step in developing the sample application was to enter the command: **prodb mag empty**, which created an empty database file called MAG.DB (for *magazine*) from the file EMPTY.DB.

The file EMPTY.DB is not really empty. It contains PROGRESS's relational metaschema, four PROGRESS files hidden from view and manipulated by the data dictionary. When a file is created using the dictionary, its name, field specifications, and index definitions are stored in the metaschema. Each user application file has a corresponding File record and as many Field records as defined fields. The metaschema holds only the file definitions; data are stored in records within the .DB database file.

The EMPTY.DB database is locked, thus preventing modifications to metaschema files, fields, or indexes. The definitions, or *schema*, of a finished application also can be locked with a utility provided with the optional Developer's Toolkit. This is useful for managing program versions or protecting an application from modification. For those interested in tweaking PROGRESS at the lowest level, an unlocked EMPTY.DB and its schema are provided in the Toolkit.

Logical data files of a PROGRESS application are stored within a single physical DOS file (figure 1). The logical files Author, Article, and Issue of the sample application are stored within the physical file MAG.DB. A log file of usage and system messages including start and stop times and any system crashes is kept in MAG.LG. While the database is in use several files are created automatically that support PROGRESS features. The before image (MAG.BI) and local before image (MAG.LBI) files keep record and

memory variable histories and are fundamental to crash recovery. The lock file MAG.LK regulates access in a multi-user environment, while MAG.PGE supports edit buffer recall after a PROGRESS program is executed. MAG.SRT and MAG.TRP provide temporary sort workspace and miscellaneous storage. All temporary files are deleted upon normal exit or are used in recovery of the database following an abnormal end or system crash.

An application's data definitions can be dumped in ASCII format to a .DF file using the load/dump facility. MAG.DF would contain all file, field, and index definitions for the MAG.DB database. These definitions then can be loaded into any other database application. If the user is designing an application in modules, the definitions of these modules can be moved into the delivery database individually.

The data are output in ASCII format delimited by quotation marks in files with the extension .D. Once dumped, AUTHOR.D, ARTICLE.D, and ISSUE.D files contain all data of the MAG.DB sample application.

File data can also be dumped from the dictionary's load/dump menu. In some cases PROGRESS does not compress character fields correctly. The stripping of trailing blanks is overlooked when data are assigned to the character field as a result of a function. For example, if a character field **mystring** is defined to have a length of 40, and **anumber** is an integer, then the assignment

```
mystring = "any old yarn" +
    string(anumber)
```

results in a 40-character field. No stripping of trailing blanks is done.

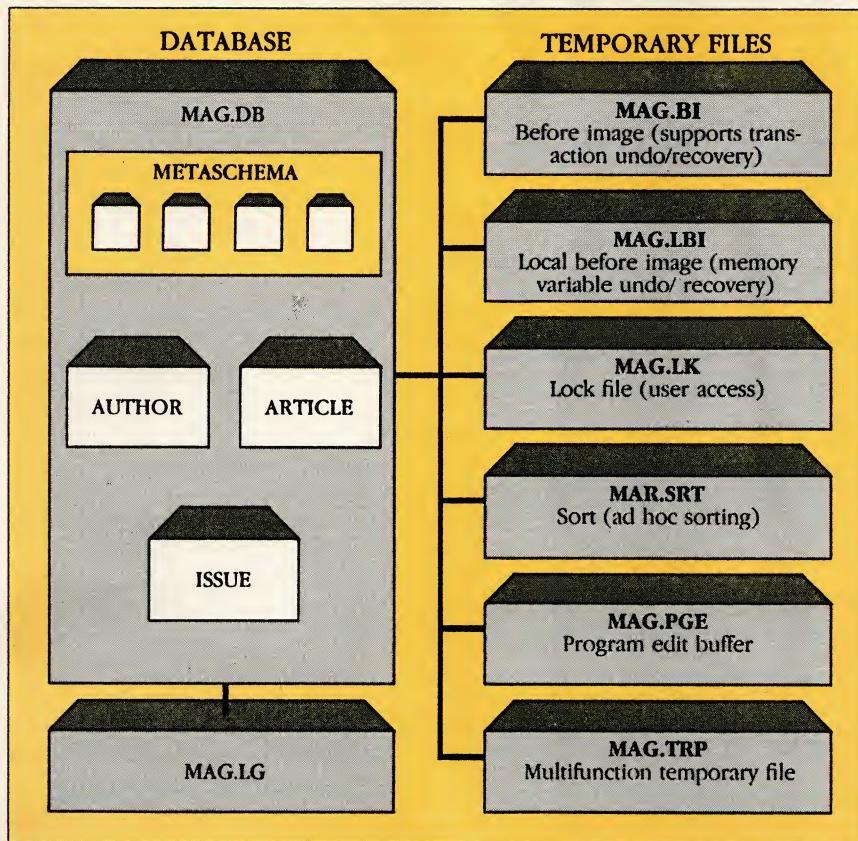
The dump/reload facility in the data dictionary corrects this and should be performed regularly upon databases where this dysfunction presents a problem. Dumping and reloading takes time, however, and is a static fix to what should happen dynamically.

Dumping and rebuilding an application from its .DF and .D files involve five steps: (1) dump the application dictionary; (2) dump the application data; (3) create an empty database; (4) load the application dictionary; (5) load the application data. Applications that are recreated in this way are often smaller in size and usually perform faster than their predecessor. The command

```
prodb <new database> <old database>
```

also makes a copy of an application, but it does not realize any savings in either size or speed.

FIGURE 1: PROGRESS Files



The logical files Author, Article, and Issue are stored within the physical file MAG.DB. A log file of usage and system messages is kept in MAG.LG. Temporary files are deleted upon exit or used in database recovery after an abnormal end.

THE PROGRESS EDITOR

Data Language has made the PROGRESS editor a backdrop to all other database activity. Entering PROGRESS is essentially the same as entering the editor. Unlike most data managers, in which the prompt/command line interfaces resemble those of DOS, all PROGRESS commands are typed directly into the editor and executed with the F1 or GO key. This is critical in achieving PROGRESS's level of integration, because after the command is executed, including dictionary calls or program executions, control is returned to the editor.

The editor, from which help can be called, is suitable for almost all program development. Programs can be loaded from disk or recalled from the program execution buffer. This gives developers a chance to explore an unexpected outcome while still retaining immediate access to their source. A typical scenario: a developer executes a program and discovers an error; by recalling the program, making an edit or dictionary change, and executing again, the programmer has participated in the edit/run/debug cycle without changing

the source file. If the results of such an investigation are successful, then the new version of the program can be saved. If, as is sometimes the case, the edits are degenerative, they can be cleared and the original program restored in just three key presses.

This full-screen editor is line oriented. Lines can be inserted, deleted, and split. Blocks of lines can be moved, deleted, or copied out to a DOS file. PROGRESS's editor has enhancements over typical line editors. For example, in harmony with the structured language, the editor has a floating left margin. Tabbing in to a nested block is not necessary because a line's left margin is equal to that of its preceding line. A search facility is provided, which reveals the editor's only visible weakness. Searches have no replace option.

An application's data entry, sorting and indexing, and reports are controlled through the PROGRESS language and dictionary. Because these two modules are combined in an integrated environment, changes made in either one can affect the ways data are displayed, retrieved, or processed.

Top Quality Programming Tools from the Developers of the TurboPower Utilities

Turbo EXTENDER™

Tired of fighting 64K Code and Data Segments? Bored while waiting for your 10,000 liner to Compile? Want to optimize those sluggish Overlays?

LARGE CODE MODEL

Write Turbo Pascal programs using all 640K of MSDOS memory, based on any number of separately compiled modules. Provides complete parameter passing using normal Pascal syntax. Heap and Data Segment are shared between all modules. No memory-resident kludges or unnatural parameter passing schemes. Comes with a utility which automatically converts your existing applications.

LARGE DATA ARRAYS

Transparently access 1 and 2 dimensional arrays of any conceivable size and type. Four models support Normal RAM to 640K, Expanded memory (EMS) to 2Meg, Virtual (Disk-based) to 30Meg, and sparse arrays like the most advanced spreadsheets. Comes with a fast full-screen array browser.

MAKE FACILITY

A Unix-like MAKE program that is optimized for the Turbo EXTENDER large code model. Rebuild multi-module programs with no wasted effort.

OVERLAY ANALYST

Perform Static and Dynamic analysis of overlaid Turbo programs. Determine sizes of all procedures in each overlay group. Monitor the running program to find the number of overlay reads, procedure calls, and the load address of all procedures.

AND EVEN MORE!

DISK CACHE can be incorporated in your program to speed up disk reads for data bases, overlays, etc. Multi-file full screen BROWSE works on any text file. Pascal ENCRYPTOR makes your source safe from prying eyes, improves compile speed 15-30% and leaves the code 100% functional. SHELL generator creates fast compiling shells of unexercised code.

Two DSDD disks with complete Source Code, 100 page printed manual, 30 day guarantee! Requires Turbo Pascal 3.0 and DOS 2.X or 3.X. Runs on IBM PC/XT/AT and compatibles. Call for generic MSDOS support.

\$85
complete

Also get the TurboPower Utilities with the acclaimed Pascal Structure Analyzer. Includes a Pretty Printer, Execution Profiler, and powerful Text and Command Automation Tools. With full source \$95, executable only \$55.

Credit Card Orders only call Toll-free 7 days per week (US) 800-538-8157x830 (CA) 800-672-3470x830 PO, COD, Dealers, Questions, Brochures, call or write:



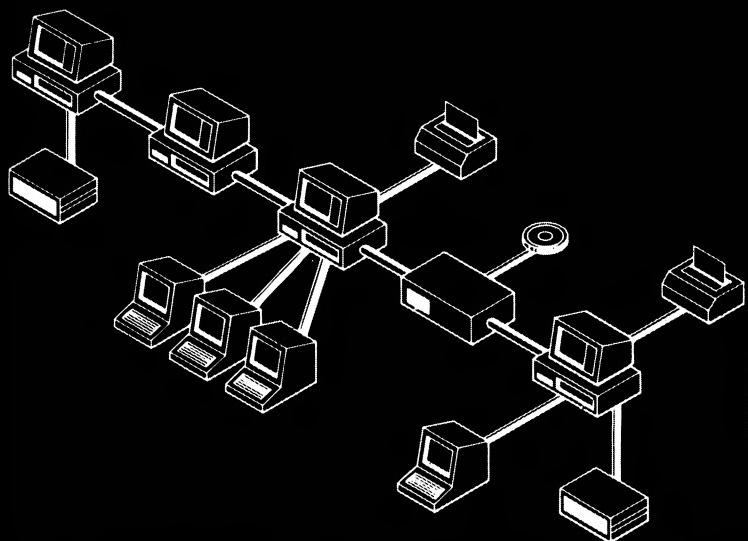
478 W. Hamilton #196
Campbell, CA 95008
ph. 408-378-3672
M-F 9AM-5PM PST

CIRCLE NO. 193 ON READER SERVICE CARD

Technical Bulletin



SUBJECT: Engineering a LAN for Maximum Flexibility.



Moodie Drive, HiTech Park, 215 Stafford Rd.
Ottawa, Canada K2H 9C1 (613) 726-1893

PROGRESS

As mentioned before, the basic processing entity in the PROGRESS language is the block. Blocks may be nested within blocks. A data display form called a *frame* exists for each block. Many PROGRESS commands are extremely powerful. For example, the DISPLAY statement performs a number of steps automatically. Through the dictionary definitions, DISPLAY can determine a file's field names, labels, display format, and the order in which fields are displayed. Screen space for these fields in the current frame is allocated, and the labels and data are displayed within a surrounding box.

Extensive options are available to the user for presenting the data within the frame; these include displaying the fields in columns, without labels, without the surrounding box, and beginning at a specific row and column number. Photo 2 shows various ways of displaying one record of the Issue file; the PROGRESS statements that were used to invoke these images are printed next to each frame.

The PROGRESS compiler supports global, shared, and local variables. Procedures may call procedures. Because variables of the same name but at separate levels of nesting are differentiated by PROGRESS, recursion is supported. The number of recursive iterations or levels of procedures is limited to a maximum of 50 nested blocks.

The compiler is invoked by pressing function key F1 (GO). Compiled procedures, indicated by .R extensions, can be mixed with uncompiled programs. Programs can also be compiled and saved from within other programs using the command **compile <program name> save**. In PROGRESS version 3, the compiler will be able to accept parameterized include files. If an error occurs during compilation, PROGRESS attempts to place the cursor as close to the culprit as possible. The help menu can immediately be invoked for dictionary, language syntax, and system message questions, so the edit/run/debug cycle is shortened considerably. Changes such as adding a missing index or modifying a field definition can be made to the dictionary quickly. The developer is not obstructed from making changes in the dictionary while programming.

No single-step mode is provided for runtime debugging. This forces the developer to resort to his own program breaks while stalking an error in logic. Syntax or compile time errors do not contribute to this problem, because PROGRESS identifies their origin with a great deal of consistency.

Brand New From Peter Norton A PROGRAMMER'S EDITOR



that's *lightning fast* with the *hot* features programmers need

THE NORTON EDITOR

Direct from the man who gave you *The Norton Utilities*, *Inside the IBM PC*, and the *Peter Norton Programmer's Guide*.



"This is the programmer's editor that I wished I'd had when I wrote my *Norton Utilities*. You can *program your way to glory* with *The Norton Editor*."

Peter Norton



Peter Norton, 2210 Wilshire Blvd., #186
Santa Monica, CA 90403, 213-826-8032
Visa, MasterCard and phone orders welcome

CLIST™ Provides Software Engineering Metrics Plus Complete Source Listings

Title: Listing of SAMPLE.C Wed 24-Apr-85 - 5:05:37pm

Source File

Line Numbers

Instantaneous Variable Depth: Helps To Highlight Areas Of Complexity

Date & Time

Source File Name:

Alphabetical Listing of Variable Names:

Average Variable Span:

Line Counts

Count of Control Statements and Boolean Operators

Metrics:

Total Lines	25	Unique Operators	20
Noncomment Lines	2	Local Operators	4
Decisions	1	Total Operators	24
Comments	23	Total Operators	24
Calculations	4	Total Operands	4
Volume	55		
Difficulty	18		

Clist™ Is A Helpful Tool For Achieving High Productivity and Quality When Debugging & Maintaining C Programs

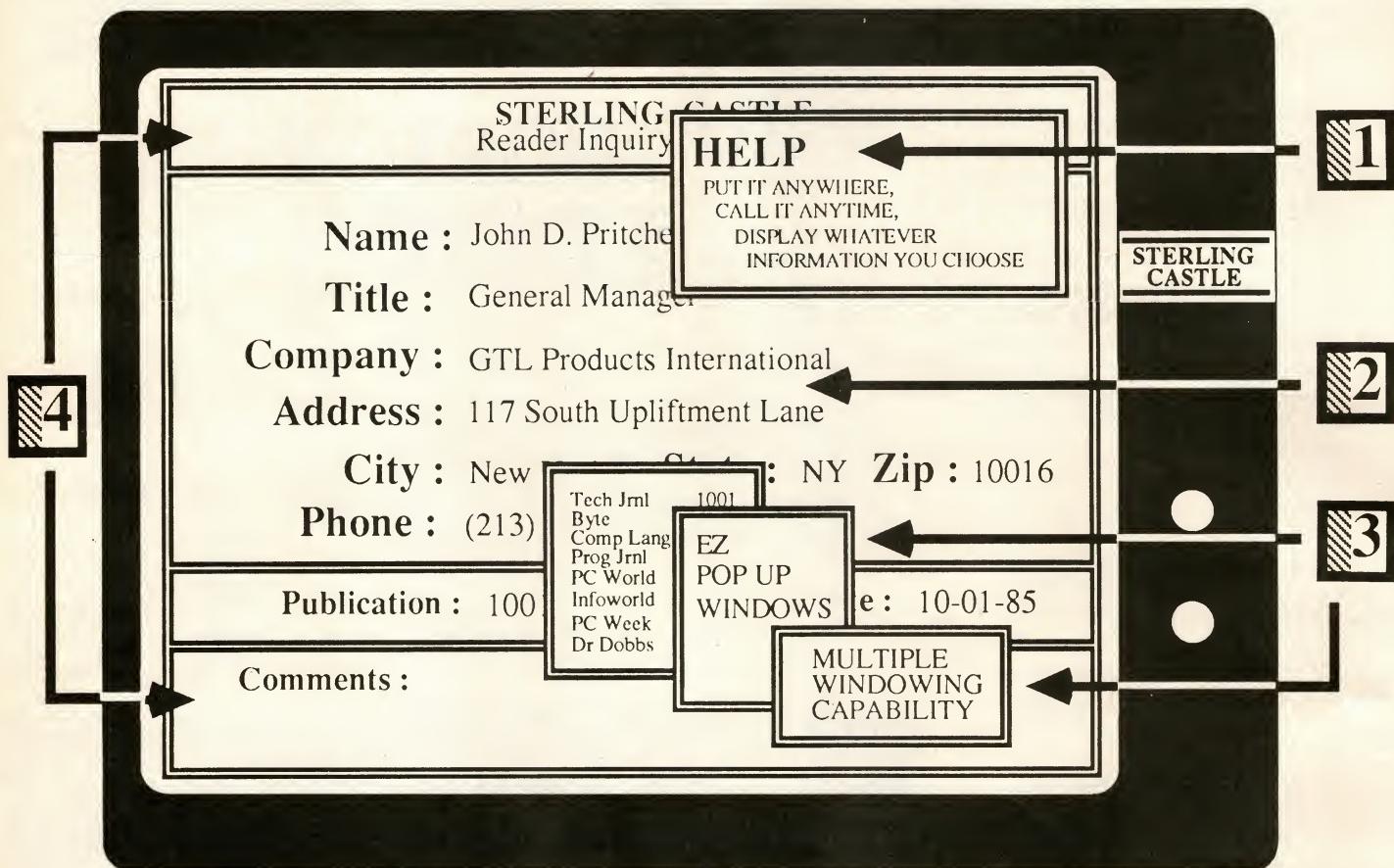
PROGRAMMING CONCEPTS, INC.

2150 Smithtown Ave., Ronkonkoma, New York 11779-7327
(516) 467-5200

CIRCLE NO. 142 ON READER SERVICE CARD

HOW TO:

1. Write Less Documentation
2. Create Bug Free Code
3. Program Faster



1 HELP MESSAGE SYSTEM

Minimize documentation! Create and edit, context sensitive, interactive help and/or tutorial functions. Turns your text information into callable libraries. Overhead to your programs is insignificant.

2 B-PLUS TREE SUB-SYSTEM

Write your program without worrying about sorting or handling of index files. Direct and sequential accessing, variable length keys, multiple non unique keys and multiple keys per record. Get first, Next, Last or Prior key in sequence. Can access a key field in less than one second. Complete source code included!

3 EZ SCREEN (pop up windows)

An Assembler language routine embedded in a basic subroutine to perform screen handling and windowing functions when called from a Basic program.

4 SCREEN BUILDER SYSTEM

Using either the built in editor or your word processor, create and edit fields of any length anywhere on the screen with full screen editing within each field and full screen movement from field to field. The generated code is ready to insert in your program. Does not use BLOAD or BSAVE. Makes no calls to BIOS.

*Requires PC or MS Dos, BASICA or Microsoft Basic *Runs under interpretive and compiled basic *Compilable under IBM, Microsoft, or QuickBASIC Compiler

75 Day Money Back Guarantee **Not Copy-protected** **Pay No Royalty**

FREE BONUS DISK: with Advanced Basic Function Library for the IBM and QuickBASIC Compilers

Any 1 Program	\$ 49
Any 2 Programs	\$ 69
Any 3 Programs	\$ 89
All 4 Programs	\$ 99

30 day
special
all 4

\$79

**STERLING
CASTLE**

Helping You to Solve Problems

702 Washington Street, Suite 174
Marina del Rey, CA 90292

CREDIT CARDS WELCOME!
CIRCLE NO. 183 ON READER SERVICE CARD
Shipping Included
No Extra Charges
CA residents add 6% sales tax

Order Hotline: 1-800-7CASTLE (in CA call: 213/ 306-3020)

PROGRESS

STATEMENTS AND FUNCTIONS

PROGRESS documentation includes a reference section describing 45 statements and 60 functions and operators in detail. Many of these commands can be manipulated by modifying phrases, giving the developer flexibility in controlling an application at a low level.

In addition to the record-manipulating statements, CREATE (add a record with default initial values), DELETE (remove a record), and DISPLAY, PROGRESS provides other macro-like statements that combine multiple commands into one. SET replaces PROMPT-FOR and ASSIGN, UPDATE performs a DISPLAY and SET, and INSERT combines CREATE and UPDATE. Each record added in this manner is automatically checked for duplicates where the indexed value is defined to be unique.

For processing several records of a file at once, PROGRESS allows specification of a record buffer.

DEFINE BUFFER

```
<buffer name> FOR <file name>.
```

Multiple records of the same file can be compared using lines such as:

```
IF buffername.field1 < filename.field1  
THEN...
```

Memory variables must also be defined and can be assigned initial values, display formats, alternate display labels, and an array dimension. The statement

```
DEFINE VARIABLE x AS INTEGER FORMAT  
"->>,>>9" EXTENT 10.
```

initializes an array of integers 10 deep. Memory variables can be declared as local, global, or shared. Variables and fields can be passed as parameters to a called procedure. A procedure that accepts arguments passed from a calling procedure must be compiled each time that it is called.

In addition to the traditional IF/THEN/ELSE branching, PROGRESS supports control of active transaction blocks using UNDO, RETRY, and LEAVE. This gives applications developers the ability to undo changes within a transaction at any time. PROGRESS programming, as a result, takes on an optimistic flavor—changes to files are made as if valid until proven otherwise. Banking records in memory variables is not necessary, because all file changes within a PROGRESS transaction can be undone.

Three looping blocks—REPEAT, FOR EACH, and DO—perform a variation of conventional looping. The REPEAT loop has default undo and error processing and transaction back-out. The FOR EACH loop adds record read-

ing. Although the DO loop has none of the default properties, it can be enhanced incrementally to include some or all of the REPEAT loop's properties.

Statistics (AVERAGE, COUNT, MAXIMUM, MINIMUM, and TOTAL) can be ACCUMULATED on fields, variables, and expressions within a looping program block. Aggregate values are returned using the ACCUM function.

Data can be easily moved into and out of a PROGRESS application using the INPUT FROM and OUTPUT TO statements. On UNIX systems that support true piping, INPUT THROUGH and OUTPUT THROUGH functions are also available options. Directing a report to a printer, file, or port is simple:

```
OUTPUT TO printer.  
INPUT FROM "myfile".  
OUTPUT TO com2.
```

A number of modifying phrases are available to control echoing of data, page formatting output (including changing page length), or choosing unbuffered input.

More than 40 functions extend the capabilities of the PROGRESS language. Beyond the expected system DATE and TIME, PROGRESS functions also return operating system version (UNIX or MSDOS) or search directory paths for files. Mathematical functions, including log, square root, and modulo, can participate in equations. The 8087 math coprocessor is not supported. String functions can appear within concatenations or within a special VALUE function that returns the character value of an expression. For example, if the variables command and parameter have been defined as character, then

```
command = "dir ".  
parameter = "a:".  
DOS VALUE(command + parameter).
```

will obediently perform a directory of drive A:. The VALUE function can be used with INPUT FROM and OUTPUT TO as well, giving the developer a means of placing operating-system-specific parameters under program control. The UNIX command "ls" can be assigned to the variable command:

```
if OPSYS = "UNIX"  
then command = "ls ". /* UNIX */  
else command = "dir ". /* MSDOS */
```

When used alone, the DOS function invokes a DOS shell on top of PROGRESS. Almost 200KB of free memory is available on a 640KB system. Virtually any standard DOS program, except those that stay resident after termination, can run in this shell. Programs

Fortran Support for IBM PC/XT/AT & Compatibles

Versions Available For:

Microsoft, Supersoft, RyanMcFarland, IBM Professional, Lahey, & IBM Fortran.

Forlib-Plus **\$69.95**

Supports graphics, interrupt driven communication, program chaining, and file handling/ disk support. A Fortran coded subroutine is included which will plot data on the screen either in linear/linear, log/linear, linear/log, or log/log on the appropriate grid.

Strings & Things **\$69.95**

Supports string manipulations, command line usage, DOS call capabilities, SHELL generation and data transmission, BATCH file control, music generation, PEEKS and POKEs, PORT access, and general register manipulations.

For-Winds **\$89.95**

Gives the Fortran programmer the capability of generating up to 255 windows on the screen. Each window can be individually scrolled, moved, sized, generated, and removed. Both color and monochrome type displays are supported. Full source code is supplied for customization.

ACS Time Series **\$495.00**

This is a COMPLETE time series analysis package which contains VERY HIGH SPEED FFTs, Filter generations, convolutions, transfer function calculations, auto and cross spectra calculations, Cepstrum, curve fitting algorithms, coherence calculations, and many other associated routines. The price includes FULL source code.

Fortran Scientific Subroutine Package **\$295.00**

There are approximately 100 Fortran subroutines included which fall under the following 12 categories:

- 1) Matrix storage and Operations
 - 2) Correlation and Regression,
 - 3) Design Analysis (ANOVA),
 - 4) Discriminant Analysis,
 - 5) Factor Analysis,
 - 6) Eigen Analysis,
 - 7) Time Series,
 - 8) Nonparametric Statistics,
 - 9) Distribution Functions,
 - 10) Linear Analysis,
 - 11) Polynomial Solutions,
 - 12) Data Screening.
- Full source code is included.



Alpha Computer Service
P.O. Box 2517
Cypress, California 90630
(714) 894-6808

California Residents
Include 6% Sales Tax

There are NO license fees

CIRCLE NO. 101 ON READER SERVICE CARD

END SCREEN MIS-MANAGEMENT.

"About the finest screen development tool around." That's how mbp COBOL's enhanced Screen Management System has been described.

PC FORMAT, MAINFRAME FEATURES. The system offers sophisticated screen handling capabilities, with RM* compatible extensions to COBOL ACCEPT/DISPLAY verbs. For maximum program clarity & convenience, screens are stored in independent mask libraries, accessed by COBOL CALL statements. The package includes a mainframe-like 'Paint the Screen' Mask Editor.

Providing runtime support: full windowing capabilities; complete fore- & background color support; both active & passive program controlled Video Attributes can be changed dynamically during program execution.

THE COMPLETE COBOL. To this superb Screen Management System, mbp COBOL adds: full PATH-NAME support; DOS command execution from within a COBOL program; an Interactive Symbolic Debug Package included standard; Multi-keyed ISAM structure; SORT & CHAIN; GSA certification to ANSI '74 Level II.

The mbp COBOL compiler generates native machine language code, so it's fast. IBM-PC* Network & Novell Netware interfaces are optionally available.

mbp KEEPS NICE COMPANY. Bechtel, Bank of America, Chase, Citicorp, Hughes Aircraft, McDonnell-Douglas, NCR, and Price-Waterhouse are companies choosing mbp COBOL. Now you know why.

LET US PROVE IT TO YOU with our free Screen Management System demo disk. But be forewarned: once you've sampled it, you'll want the whole thing. **mbp COBOL. \$900.**

mbp COBOL requires an IBM-PC, -XT, -AT or a close compatible and 192K main memory. (Inquire about mbp for Unix, Xenix & other systems.)

*RM is a Ryan-McFarland TM. IBM-PC, -AT & -XT are International Business Machines TMs.

CIRCLE NO. 172 ON READER SERVICE CARD

Please send me complete mbp information, and tell me how I can receive a free mbp COBOL Screen Management System demonstration diskette.

NAME _____

COMPANY _____ PHONE _____

ADDRESS _____ CITY/STATE/ZIP _____

PROGRESS

such as the DOS PRINT command, which claim a portion of RAM for buffering, should be run before entering PROGRESS. Otherwise, PROGRESS will have a noncontiguous RAM pool and will generate an "stget out of storage" error message even though the system RAM is quite adequate.

When used with OUTPUT TO, printer attributes such as bold or compressed print can be sent easily. Control codes are described as octal numbers preceded by a tilde (~). The program

OUTPUT TO PRINTER.

*display ~017. /*017 = 15 decimal */*

sets an IBM-compatible dot-matrix printer to compressed print mode.

The PROGRESS database has an enhanced understanding of relationships between files. One-to-many and many-to-one relationships are defined informally and naturally by shared field names. Any related files whose common fields are given the same name can be described naturally using the OF phrase. This PROGRESS program from the sample application locates the issue of a given article and then displays all the articles published in that issue:

FIND Issue OF Article.

FOR EACH Article OF Issue:

DISPLAY Article.

Each file that is in use within a PROGRESS program block has a corresponding active record stored in a record buffer area. The user can select a record buffer area up to 31KB, which presents the only limit to the number of files that can be open at one time. Exiting to another program module closes all record buffers (files) not in use.

Other than the powerful screen formatting commands and the ease of relating files, the user is given no means of producing reports without programming. A report builder is missing from PROGRESS 2.3d, forcing developers to create utilities. PROGRESS version 3 will allow automatic Ctrl-Breaks on fields to execute routines or to allow PROGRESS to subtotal values.

END-USER FACTORS

PROGRESS is installed easily onto a hard disk from four diskettes that are not copy protected. The installation program, INSTALL.BAT, allows specification of a directory to hold PROGRESS, although the default C:\DLC is recommended. Dozens of example programs, once run, should be deleted from systems in which storage space is a problem. The PROGRESS program is less than 350KB in size, but the on-line help, dic-

To learn how you can receive a free mbp COBOL Screen Management System Demonstration Diskette, send the coupon below, or call toll-free: 800-231-6342. In California: 1-800-346-4848.

*RM is a Ryan-McFarland TM. IBM-PC, -AT & -XT are International Business Machines TMs.

CIRCLE NO. 172 ON READER SERVICE CARD

Please send me complete mbp information, and tell me how I can receive a free mbp COBOL Screen Management System demonstration diskette.

NAME _____

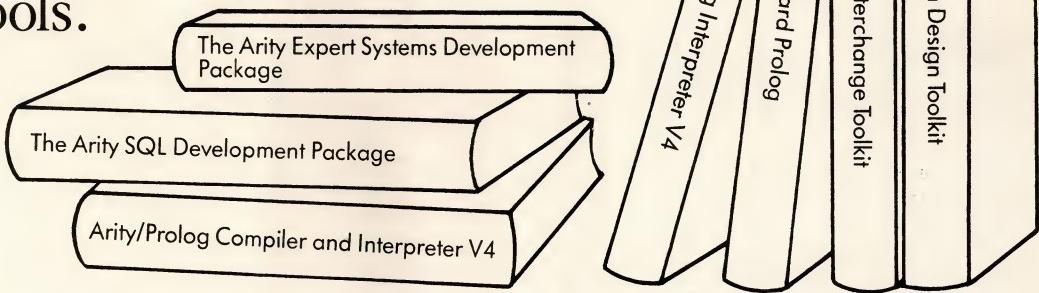
COMPANY _____ PHONE _____

ADDRESS _____ CITY/STATE/ZIP _____

mbp Software & Systems Technology, Inc.
1131 Harbor Bay Parkway, Suite 260
Alameda, CA 94501
For service, phone: (415) 769-5333



Why your next generation of products should use our 5th generation tools.



Arity's integrated family of programming tools allows you to combine software written in Arity/Prolog, the best of the fifth generation languages, with Arity SQL, the best of the fourth generation languages, and with conventional third generation languages such as C or assembly language to build your smarter application.

You can use Arity/Prolog to build expert systems using the Arity Expert Systems Development Package. Or to build natural language frontends. Or to build intelligent information management systems. Arity/Prolog lets you build advanced technology into your vertical applications package.

And more...

That's not the whole story. Arity's products are all designed to be fast, powerful, serious. Each of our products contains unexpected bonuses. Such as a one gigabyte virtual database integrated into Arity/Prolog. The most powerful of its kind on a PC.

Quality first. Then price.

In order to be the best, we had to prove it to our customers. Our tradition of quality software design is reflected in every product we sell. Quality first. Then price. And we always provide the best in customer support.

Our products are not copy protected. We do not charge royalties. We offer generous educational and quantity discounts. And we have a 30 day money back guarantee.

Try us to know that we keep our promise on commitment to quality and reliability. Try us by using our electronic bulletin board at 617-369-5622 or call us by telephone—you can reach us at 617-371-2422.

Or fill in this coupon. Whether you order today or not, let us send you full descriptions of our integrated family of Arity products.

CIRCLE NO. 136 ON READER SERVICE CARD

arity

We design and distribute high quality, serious application software for the IBM PC, XT, AT and all MS-DOS compatibles.

Please complete this form to place your order and/or request detailed information.		Quantity	Info only
Arity/Prolog Compiler and Interpreter V4	\$795.00	_____	_____
Arity/Prolog Interpreter V4	\$350.00	_____	_____
Arity Standard Prolog	\$ 95.00	_____	_____
Arity SQL Development Package	\$295.00	_____	_____
Arity Expert System Development Package	\$295.00	_____	_____
Arity Screen Design Toolkit	\$ 49.95	_____	_____
Arity File Interchange Toolkit	\$ 49.95	_____	_____
TOTAL AMOUNT (MA residents add 5% sales tax) (These prices include shipping to all U.S. cities)	\$ _____		

NAME _____

SHIPPING ADDRESS _____

CITY/STATE/ZIP _____

TELEPHONE _____

Payment: Check PO AMEX VISA MC

Card # _____ Exp. date _____

Signature _____

ARITY CORPORATION • 358 BAKER AVENUE • CONCORD, MA 01742

arity



Interactive DOS Utility \$49⁹⁵

Resident program gives you instant access to many enhanced DOS functions and instant return to where you were.



* **Reduce time searching for your files and performing DOS commands.** See up to 85 files per screen page. Identify sub-directories at a glance. Get quick and easy display of contents.

* **Make your DOS commands easier to use.** Pop up windows simplify DOS operations, utilize single keystroke commands, return you instantly to where you left off.

* **Take full control of your printer.** Call up printer output window from inside any program and give necessary printer commands.

"WindowDOS quickly established itself as an indispensable part of my PC environment. I can't imagine working without it."

Paul Bonner, Reviewer, PC Week



\$49.95

Plus \$5 handling and shipping

**1-800-433-5355
Texas 214 264-2626**

Money orders, cashier's checks, VISA, MC,
AmEx, and Corporate Purchase Orders.

**Software of the Future
Box 531650 Grand Prairie, TX 75053**

WindowDOS is for use with IBM PC, XT, AT and true compatibles. Requires DOS 2.0 or newer and 80 column display. Uses only 40K of memory.

CIRCLE NO. 127 ON READER SERVICE CARD

154

PROGRESS

tional, source, and demo files bring system storage requirements up to 2MB. PROGRESS requires that DOS be configured for 23 files and at least 20 buffers; that is, the lines "files=23" and "buffers=20" should be put in CONFIG.SYS, although optimal performance is achieved at 30 to 35 DOS buffers. The system PATH must include C:\DLC, the default home directory for PROGRESS, or an alternative, user-specified subdirectory can be substituted.

PROGRESS software applications can be delivered under three complementary data management environments: full PROGRESS, QUERY/RUNTIME, and RUNTIME. Each configuration provides different levels of data, application, and source-code protection. By selecting the environment, applications developers can control with much flexibility the degree to which their data management system will be open or closed.

With full PROGRESS the user can make direct updates to data, change any unlocked portion of the application dictionary, and make modifications to source code. This access can be restricted by compiling some or all of the procedures and freezing the dictionary. If the entire dictionary is frozen, file definitions can be added, but preexisting definitions cannot be changed.

QUERY/RUNTIME is preferred for systems in which end-user files are interrelated and changes to them from outside of the application undesirable. The user is given read access to all of an application's data files. Data can be dumped, reports and tabulations created, and ad hoc queries performed. QUERY/RUNTIME is almost identical to PROGRESS, except that the file create and delete menu options are omitted from the dictionary. Unlike full PROGRESS, however, procedures that change data cannot be compiled under QUERY/RUNTIME. Developers must compile their applications under PROGRESS and move these procedures to a QUERY/RUNTIME application. This is very effective in giving the user a safe interface to data.

The highest degree of application security is afforded by RUNTIME PROGRESS, which executes only compiled programs. Compiled .R files of an application and the database .DB file, are moved from full PROGRESS to RUNTIME. RUNTIME is less expensive, occupies less than 400KB of disk storage, and keeps data and logic under application control away from the end user.

The PROGRESS Developer's Toolkit aids in the delivery of applications. A COMPILE utility is used to create a single program that compiles and saves all

procedures of an application. A DBFREEZE utility locks the application dictionary. An application database also can be labeled using DBLABEL, which ensures that compiled procedures of the correct version are being run. The remaining parts include a metaschema that can be modified (an unfrozen EMPTY.DB), a database freeze/label status program, and a number of batch files that can be used to install a developer's PROGRESS application.

Data entry and movement between PROGRESS application modules are easy to learn. Users can move the cursor to any highlighted or underlined data entry fields. Data fields can be edited using the Insert and Delete or Backspace keys and are always checked for validity against the dictionary entry. Automatic checking substitutes error handling code that otherwise might not be practical to include. For example: if 2/29/86 is entered into any date field, PROGRESS will generate an invalid date error because 1986 is not a leap year.

If the PROGRESS developer exercises reasonable care in naming fields, the application's error messages will read naturally. If the application fails to find an author, the PROGRESS-generated error message would be "Author record not on file." These messages replace most of the error handling coding typically required by vertical market applications and ensure a more consistent user interface. In the event of error, the current programming block is easily undone and retried. If, as in the above example, an author is not found, the user is given the option to edit input or leave. All these error handling, transaction processing, and retry capabilities are provided as PROGRESS defaults in the following program lines:

PROMPT-FOR Lastname Firstname.

FIND Author USING Lastname AND

Firstname.

An index can be specified as unique in the PROGRESS dictionary, which prohibits any duplicate records from being added to the file. Again, error reporting is clear:

** Author already exists with Lastname
"Doe" Firstname "John".

In reality, two authors can have the same name. The addition of an author number and changing the author name index to not-unique is all that would be required to correct this design limitation of the sample application. Supporting authors of the same name can be performed without dumping data or making major software modifications.

The LAN Rush is On!



Everybody is rushing to install a local area network. But the smart buyers are hitching their wagons to the LAN that gets results.

TiaraLink is the price/performance leader.

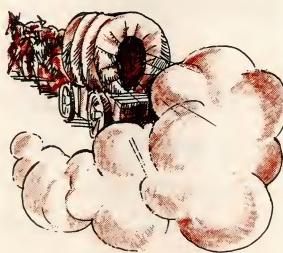
You need a local area network to share your important business data. You must have speed...You want performance.

Independent studies published in PC TECH JOURNAL and Mini-Micro Systems† confirm TiaraLink performs significantly faster than 3Com Etherseries*, Corvus Omninet*, or Orchid PCnet*. And comparably to Novell NetWare*. So we're fast!

Now, new enhancements simplify network installation. Operating TiaraLink is as easy as ever. Unique features including CHAT, for network messaging, and IAP** simplify accessing of network printer.

And TiaraLink is no stranger in town. Around for three years, we've installed over 2,000 networks for

TiaraLink™ Leads the LAN Rush.



Our Prices Leave Everybody Else in the Dust!

IBM* PC, XT, AT, and compatibles. TiaraLink is the proven LAN.

TiaraLink is definitely a front runner in performance. But what about price? Well, most companies charge you a large chunk of money for every station or file server you need. The TiaraLink network card is only \$495, and a one time purchase price of \$500 gives you systems software to operate the entire network — up to 255 nodes. Our prices leave everybody else in the dust!

Don't get trampled in the LAN Rush. Investigate the LAN that offers top performance at the lowest price: TiaraLink. Call us at **1-800-423-1268**. In California call **1-800-325-6223**. Or write to us for more facts on TiaraLink. Dealer and manufacturer representative inquiries invited.

†Copies available upon request. **In-Application Printing.

TIARA
COMPUTER SYSTEMS, INC.

2685 Marine Way • Mountain View, CA 94043 • (415) 965-1700 • TLX 4996251 • FAX (415) 965-2677

Trademark/Owners: TiaraLink is a registered trademark of Tiara Computer Systems, Inc.; IBM/International Business Machines Corp.; Etherseries/3Com Corp; Omninet/Corvus Systems, Inc.; NetWare/Novell, Inc.

CIRCLE NO. 182 ON READER SERVICE CARD

Which Would You Prefer?

A>—
This
or
This ↓

*Customize Your System
with the Ultimate
"Productivity"*

Drive C	Name	Ext	Size
	Bourbaki	Inc	VOLUME
	DATABASE		► SUB-DIR
	HELP		► SUB-DIR
	INFOSTAR		► SUB-DIR
	LOTUS		► SUB-DIR
	NETSYS		► SUB-DIR
	PALANTIR		► SUB-DIR
	SYSTEM		► SUB-DIR
	TELECOM		► SUB-DIR
	THINK		► SUB-DIR
	WONDER		► SUB-DIR
	WORDS		► SUB-DIR
	NOTES		1647
	APPOINT	APP	0
	AUTOEXEC	BAK	128

Select →

C > "Wonder" Provides UNLIMITED USER DEFINABLE Menu/Macro Capability !!!

[Compose Copy Type Rename Erase Date Mkdir Options]

Simply Press F10 to Display ONE of Your APPLICATIONS MENUS !!

[LOTUS EDITOR INFOSTAR DBASE THTANK HAYES NETWORK HELP]

The 1 DIR Version 3.50 — Copyright (c) Bourbaki, Inc. 1983, 1984, 1985



FILE MANAGER & MENU SYSTEM

"WONDER" integrates a powerful File Management System with extensive user definable Menu/Macro capability. Create menus and program single keystroke commands to run any or all of your applications. Create your own customized HELP system for yourself or other users. In addition, version 3.5 provides full color support, menu password protection, CUSTOM multiple file operations, CUSTOM prompted commands, plus much more.

If you are a member of the growing population of new PC users, whose interest lies primarily in taking advantage of the computer as information management tool, this program was designed for you. If you have a hard disk, you shouldn't be without it! **1 dir** is licensed by more hard disk manufacturers than any other visual shell.

PC Products — 8/85 The **1 dir** of DOS — Tim Daneliuk, Contributing Editor

"Quite simply, **1 dir** works flawlessly . . . **1 dir** is a well conceived and implemented product that is wholeheartedly recommended for virtually anyone who uses their PC often. It provides an easy-to-use doorway into DOS and is flexible enough for novice and expert alike."

"WONDER" is also a *perfect Training Tool* that grows *with the user!*
A real *problem solver* for MIS Managers and Systems Integrators.

Works with the IBM PC/XT/AT family. (DOS 2.00 — or higher), plus compatibles.

Call, write or see your local dealer for more information!
Evaluation copies available to dealers and corporate clients.

Bourbaki Inc.TM

\$95.00

PROGRESS OVERVIEW

PROGRESS 2.3d

Data Language Corporation, 47
Manning Road, Billerica, MA 01821;
617/663-5000

Product type. A relational data management applications development system that is specifically designed for transaction processing. The integrity of the database is assured through the product's capability to undo the current transaction, as well as to recover after a system crash. Most source code is portable among all systems. The product features an integrated editor, a compiler, help and error reporting, a data dictionary with dump/restore capabilities, and an intelligent display manager. Multiple users are supported in systems other than DOS.

IBM PC environment. PC, PC/XT, or PC/AT running under DOS with a hard disk and at least 512KB of memory. PROGRESS also runs on an AT under XENIX.

Other environments supported. The following UNIX systems are supported: AT&T 7300; DEC VAX 11/780, 11/750, 11/730, and Micro VAX II; Fortune 32:16; NCR Mini Tower, Tower 1632, and Tower XP; Plexus P-15, P-20, P-35, and P-60; AT&T 3B2/300, 3B2/400, and 3B5; Cadmus; Motorola 2000, 6300, and 6600; Sun-2; Burroughs XE550; Pyramid 90XX; and Convergent Technologies Miniframe, Megaframe, and Mightyframe.

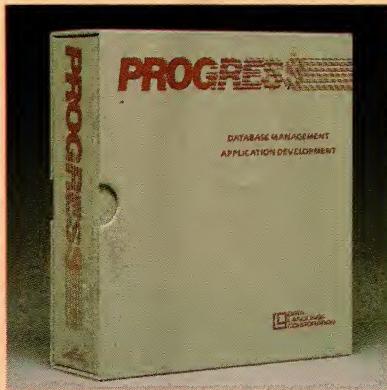
Network support. Networks are not supported by PROGRESS.

Copy protection. The PROGRESS software is not copy protected.

Help facilities. An on-line help facility is available that provides language syntax, gives explanations of recent error messages, lists keyboard program function assignments, and provides help in using the editor.

Documentation. Excellent documentation is supplied with the introduction, tutorial, reference, appendices, and index sections. A hardware-specific "System Management Guide," a "Getting Started" section, on-line tutorial, and sample database are provided.

User interface. Users communicate with PROGRESS through a combination of function keys, menus, and commands. All commands are first entered into the editor, then run by pressing a function key.



File capacities. The database is contained in a single operating system file, which is not otherwise limited in size. The database can hold up to 1,023 files and 1,023 indexes (each file must have one index). The number of files that can be open simultaneously is limited only by the record buffer area (the user defines the record buffer to be from 1KB to 31KB). No limit exists to the number of indexes allowed per file, but each index is limited to 10 fields, or 127 bytes. A maximum of 2,000 bytes is allowed per record; the number of fields is limited only by record size.

Field types and capacities. The character, decimal, and integer fields can vary in length. Arrays are supported for each field type. Date: 1/1/32768 B.C. through 12/31/32767 A.D.; Character: limited only by the input/output line width; Decimal: 50 digits total, up to 10 decimal places; Integer: -2,147,483,648 to 2,147,483,647; Logical: true/false, yes/no, or assignable pairs of values.

Access to system facilities. Commands can be passed to the operating system command line processor.

Data entry. The fully integrated data dictionary permits field definitions and subsequent modification, as well as index additions or deletions without necessitating dump/reload. Fields can be given display formats, default values, and specified as required.

Query and sorting. The optional QUERY/RUNTIME product provides the user with access to the PROGRESS language, while permitting only programs compiled under the full development system to modify data.

Reporting. No separate report facility is provided. However, the PROGRESS language does allow the building of reports with accumulations on fields,

variables, and expressions, and provides functions for determining the output line count.

Security. Access to files and fields may be controlled by user ID in multiple user (UNIX) systems. The CAN-DO function tests user permissions on a field. Fingerprinting of a database prevents theft of compiled code.

Utilities. The PROGRESS Developer's Toolkit aids in the delivery of applications. A compile utility creates a single program that can compile and save all procedures of an application. A DBFREEZE utility is provided to lock the applications dictionary. An application database can be labeled using LABEL, which ensures that compiled procedures of the correct version are being run. Also included are a modifiable metaschema (an unfrozen EMPTY.DB), a database freeze/label status program, and a number of batch files that can install a developer's PROGRESS applications.

Applications development facilities. A compiler/interpreter with looping blocks, nested procedures, functions, calls to the operating system command line processor, a sophisticated frame-based display facility, import/export functions, output redirection, parameter passing, global and local variables, shared variables, arrays, multiuser operators, default and declared transaction scoping, source protected compiled delivery, a syntax checker, and an error processing is provided with PROGRESS.

Data compatibility. PROGRESS accepts input from files in which fields are separated by blanks, text strings containing blanks are surrounded by quotes, and quotes in the data are represented by two sets of quotes.

Distribution. Direct sales and dealers.

Price. PROGRESS database/applications development system, \$695 (PC DOS) to \$19,500 (VAX 11/780); QUERY/RUNTIME, \$400 (PC DOS) to \$12,000 (VAX 11/780); RUNTIME \$200 (PC DOS) to \$6,000 (VAX 11/780); Developer's Toolkit \$350 (PC-DOS) to \$9,750 (VAX 11/780).

Support. An introductory System/Demo is available for \$50, and 90-day telephone support is included with product. Introductory and advanced classes are \$895 per person. A newsletter and applications catalog also are available to users.

—MK

PROGRESS

Adding an author to the database would still be done with the line

INSERT Author.

but the dictionary would be checking the record's author number for its uniqueness, instead.

THE DIFFERENCES

PROGRESS redefines what can be done in one day by an applications developer. The results of the benchmarks of *PC Tech Journal*'s sample editorial system are shown in table 2. Two values are shown for each benchmark; the first is the measured time when PROGRESS was invoked without integrity checking (-i); the second column reflects the measured time with integrity checking. In most cases in which data are being modified, integrity checking charges a small price in performance because the before image file is being updated. The biggest difference was in loading the Author file. This is the case in which Data Language recommends integrity checking not be used. The company does recommend backing up the database before loading the data, so recovery is easy in case a problem occurs during the data load.

PROGRESS takes approximately 15 seconds to load. This happens infrequently, however, because the edit/run/debug cycle never exits PROGRESS. On larger multiuser systems, start-up can take two or more minutes. This can be frustrating when moving between applications frequently, but only occurs once a day in delivered applications.

As of yet, no PROGRESS users' groups have formed, so the many tools

TABLE 2: Benchmark Results

BENCHMARK TASK	TIME (secs)	
	Without data integrity	With data integrity
Add 900 records to an empty database table	139	363
Index table on two fields (7 bytes)	73	79
Document and tally codes from one column	20	19
Mass change of one column (28 rows of 900)	2	10
Extract selected records to create a text file	2	2

When data are being modified, integrity checking hinders performance because the before image file is being updated. The biggest difference shows in loading the Author file; in this case Data Language recommends not using integrity checking.

that can be developed by and for PROGRESS developers lack a means of distribution. Data Language Corporation has a newsletter and is compiling a catalog of vertical market applications that have been developed in PROGRESS.

At this writing, Data Language is conducting beta tests of PROGRESS version 3.0. This new version is a marriage of numerous suggestions by developers and Data Language's own technical goals. Additions include frame modifiers, increased keyboard support, and the capability to spread a database over multiple volumes.

No matter how exciting these new features are, PROGRESS 2.3d and all future versions share the qualities that differentiate it from any other microcomputer data manager on the market today—transaction processing, fourth generation PROGRESS language, automatic crash recovery, dynamic data dictionary, portability, integrated operating envi-

ronment, and an extremely tight edit/run/debug cycle. Applications are well insulated from hardware dependence and can be transported among a variety of systems safely as separately encrypted ASCII or EBCDIC files. (The dictionary, .DF, .D data files, and source code are 100 percent character data and are all that are required to reconstruct a PROGRESS application).

While delivering fourth generation development technology, Data Language still has managed to preserve the developer's control over an application. Because it is such an effective programming tool and gives its applications qualities whose time has come, Data Language Corporation's PROGRESS may be the sleeper of vertical market and custom software development.

Mark Karaman is an international consultant for Vanguard Computer Services, which is located in Philadelphia.

TRUE MULTI-TASKING!

TASKMASTER is high tech, available now, and it works with virtually all DOS software. Give Lotus, Sidekick, Multimate or most any DOS program the advantages of real multi-tasking. It's simple to use, compatible, bulletproof and most of all, it won't slow you down. That's because TASKMASTER only shares your computer when YOU want it shared. At other times, your visible program runs at full speed, waiting for you to easily switch from program to program at the touch of a key. Compatible with most DOS computers including the IBM PC/XT/AT/Jr. series, you can order TASKMASTER today for only \$69.95 + 5.00 Shipping and Handling, VISA and Mastercard.

ORDER LINE
(206)367-0650

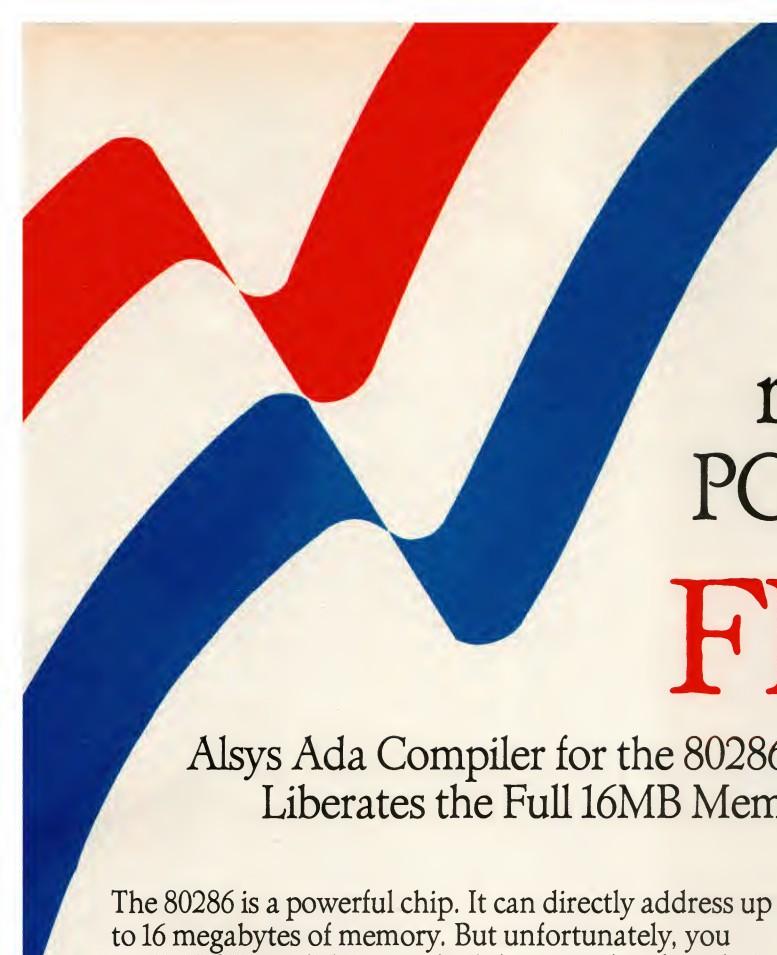
Taskmaster trademark Sunny Hill Software.
Lotus trademark Lotus Development Corp.
Sidekick trademark Borland Intl.
Multimate trademark Ashton Tate.

**Sunny Hill
Software**



13732 Midvale North Suite 206
Seattle, Washington 98133

CIRCLE NO. 152 ON READER SERVICE CARD



Announcing a radical new idea in PC-AT programming: **FREEDOM**

Alsys Ada Compiler for the 80286 Defeats the Tyranny of 640K DOS;
Liberates the Full 16MB Memory Capability of the Processor

The 80286 is a powerful chip. It can directly address up to 16 megabytes of memory. But unfortunately, you can't. DOS won't let you. And the compilers for whatever language you are currently using won't let you.

Until now.

Alsys has developed a new Ada compiler for the IBM PC-AT. Ada, of course, is the language mandated by the DoD for critical applications. Many believe it will be the dominant language for the rest of the eighties and nineties.

But leave aside Ada's virtues as a highly maintainable, portable, readable, software engineered language. Leave aside its acceptance and sponsorship by DoD, NASA, NATO, the FAA and large numbers of commercial users. Forget (if you can) the \$12 billion forecast in just DoD Ada sales through 1989.

Think only of a million plus lines of code running on a PC-AT! And think of the code executing *faster* than C or Pascal!

Think of the programs you could write if you could address 16 megabytes!!

It's like moving your AT from primitive to professional, roller skates to Rolls Royce. It lets you and your AT do everything you were meant to do.

The new Alsys Ada compiler, 300,000 lines of Ada code and self-compiled (with only 3 megabytes of memory!), also provides complete memory protection. An incorrect program affects no areas of memory except those allocated to the program. In particular, the operating system cannot be destroyed. And it does this, under control of DOS, *without any changes to DOS of any kind!*

No more Alt-Ctrl-Del restarts after a bug damages DOS!

Alsys is the premier Ada company in the world. France, U.S., U.K. And is about to become the premier AT compiler company in the world, too. For any language. For serious programmers frustrated by DOS.

Use the coupon now. Or Call. Freedom is a precious thing.



Alsys, Inc. • 1432 Main Street
Waltham, MA 02154 • U.S.A.
Phone: (617) 890-0030 • Telex: 948536

Alsys, Ltd. • Partridge Hse, Newton Road
Henley-on-Thames • Oxon RG91 EN, England
Phone: (0491) 579090 • Telex: 846508

Alsys, S.A. • 29, Avenue de Versailles
78170 La Celle St. Cloud • France
Phone: (3) 918.12.44 • Telex: 697569

ALSYS, INC.,
1432 Main Street,
Waltham, MA 02154

Tell me more about a million lines
of code on an AT. Send me literature.

Call me. Tell me about prices, delivery,
warranties, support.

Name _____

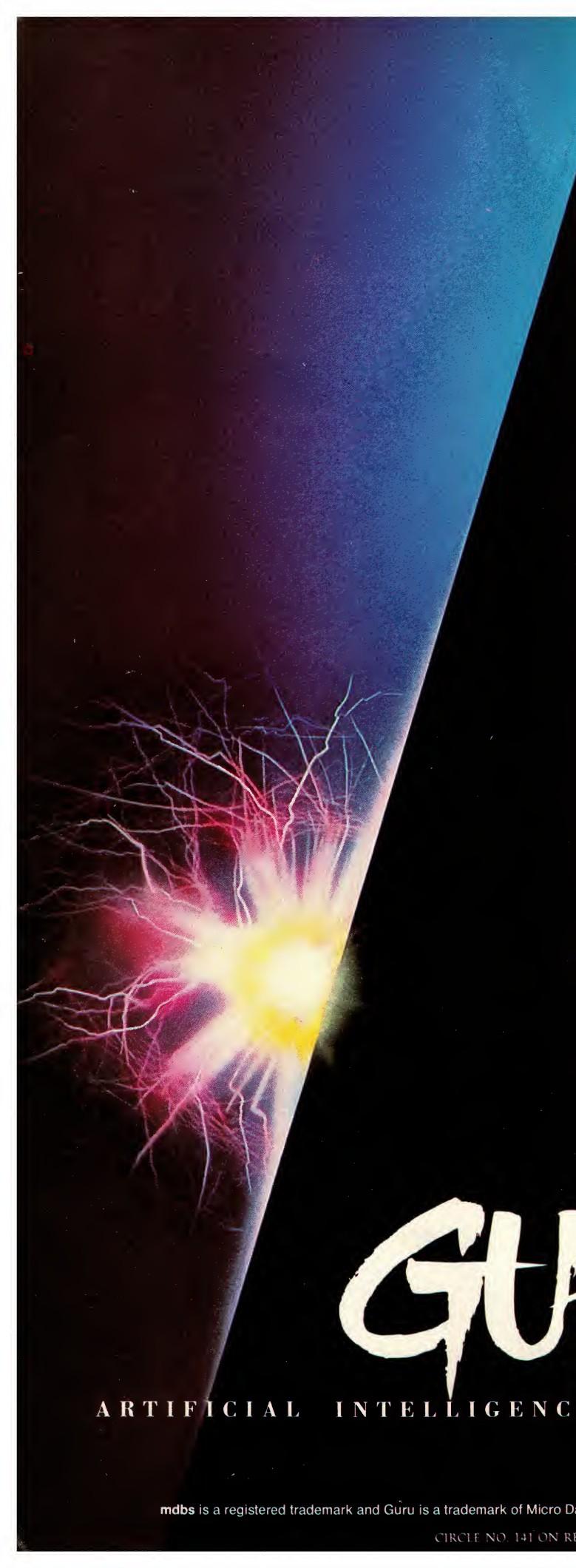
Company _____

Address _____

City _____ State _____ Zip _____

Phone () _____

PCTJ385



THE GREAT ESCAPE!

FROM IVORY TOWERS AND
COLD COMPUTER ROOMS TO
THE WARMTH OF YOUR OFFICE.

**Artificial intelligence for business
has arrived in a revolutionary new
product . . . Guru.**

At last, artificial intelligence designed especially for business! Guru brings together expert system capabilities of artificial intelligence, the productivity of familiar business computing tools and the ease of communicating with your computer using menus, commands or plain English. All available in a single, integrated program.

Guru works like human experts, considering uncertainties, reasoning through forward and backward chaining, asking for more information when needed, and explaining its recommendations.

Guru's expert system works hand-in-hand with all the familiar business computing tools like spreadsheets, statistical analysis, business graphics and a programming language, always available for both expert consultation and your everyday business computing needs.

Best of all, you won't need to learn LISP or PROLOG or buy fancy computers . . . Guru runs on your PC and communicates in plain English! Guru is artificial intelligence that means business.

For more information, call or write Micro Data Base Systems, Inc./Marketing & Sales, P.O. Box 248, Lafayette, IN, 47902, 317/463-2581, Telex 209147 ISE UR.

GURUTM

ARTIFICIAL INTELLIGENCE THAT MEANS BUSINESS.

mdbs is a registered trademark and Guru is a trademark of Micro Data Base Systems, Inc., P.O. Box 248, Lafayette, IN, 47902



CIRCLE NO. 141 ON READER SERVICE CARD

Taking Command in Turbo Pascal

With the library SPMMLIB.PAS to free the necessary memory, users can access DOS functions and features from within Turbo Pascal programs.

In "Improving Turbo's I/O" (Cole Brecheen, September 1985, p. 104) the author discussed many and diverse functions that can be added to Turbo Pascal to increase the language's flexibility. To be added to the list is a library that allows the user to access COMMAND.COM from within Turbo Pascal. The library uses DOS's memory-management functions to free memory for the command processes and for further subprocesses (see figure 1). This collection of subroutines is as simple to use as Turbo's standard procedures and functions, yet it extends the scope of Turbo and makes it a more viable programming environment.

Turbo Pascal is already equipped with some memory-management facilities. Dynamic variables can be created and deleted on the Pascal heap using the standard procedures New, Mark, Release, GetMem, and FreeMem. In addition, a compiled Turbo program can execute other compiled Turbo programs using the standard procedures Chain and Execute. In these instances the transfer of control is permanent. However, when using the routines developed here to work with DOS facilities, Turbo programs can release unneeded memory to the system, instruct DOS to load and run any other executable program, and continue processing after the subprocess is finished.

MANAGING MEMORY

In versions 2.0 and later, DOS maintains memory control blocks, which determine the allocation of each contiguous block of system memory (see "Managing Memory," William J. Redmond, August 1984, p. 42). Some of the memory in this resource pool, such as that occupied by the resident portion of DOS, is permanently withheld from user applications. The remaining memory is allocated to applications or used by the operating system as required. Careful control of memory blocks is es-



ILLUSTRATION • MACIEK ALBRECHT

sential for multitasking systems and other schemes in which several programs reside in memory at once.

DOS allocates memory to a .COM program in a procedure that requires several steps. First, the largest available block of contiguous memory is allocated to the program. This block usually is comprised of all memory beyond that used by the resident portion of the operating system, including any extensions (such as device drivers, printer buffers, RAM disk simulators, and memory-resident utilities). Multiprogram operating environments such as TopView, however, allocate only a portion of all available memory to the program.

In the second step of this procedure, DOS constructs a program segment prefix (PSP), which contains control information, in the first 100H bytes of the memory block. Next, the program code is placed in the block immediately following the PSP, and, finally, control is transferred to the first word of the program's executable code. The procedure for executing an .EXE program is similar. The difference is that DOS performs relocation when loading the program and allocates only as much memory as is required. IBM suggests that a well-behaved program should release *all* unused memory to the resource pool, freeing it for other uses.

The function calls for memory management that are available with DOS can allocate, deallocate, and reallocate blocks of memory. To call a DOS function, an application loads the function number in the AH register and executes interrupt 21H. If DOS is unable to carry out the request, the carry flag is set and an error code (the meanings of which are explained below) is passed back in the AL register.

Function call 48H (allocate memory) requests the allocation of a contiguous block of memory that contains the number of 16-byte paragraphs specified in BX. If the amount of memory available for allocation is sufficient to satisfy the request, DOS complies and returns in register AX the segment address of the newly allocated block. If the amount of memory available is not sufficient, DOS returns in register BX the paragraph size of the largest block of memory that is available.

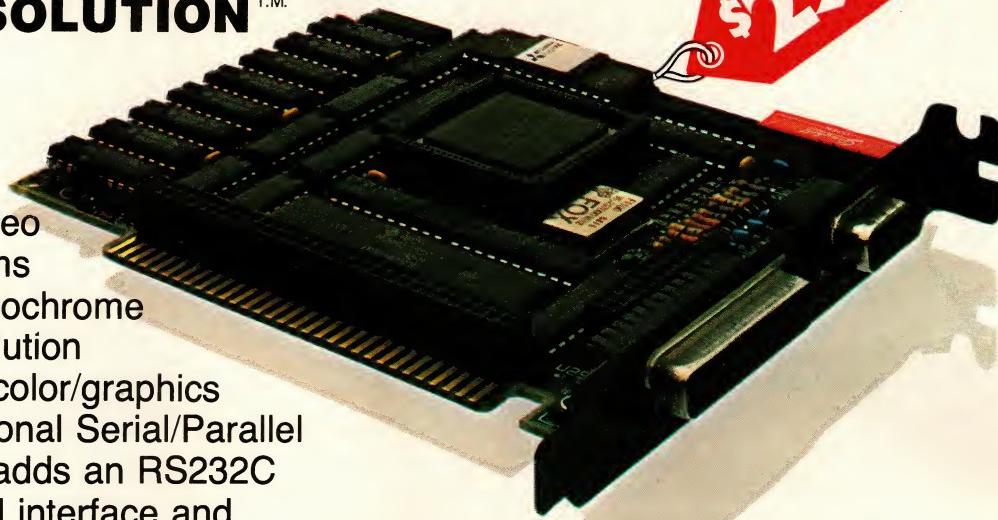
Function call 49H (free allocated memory) instructs DOS to return a previously allocated block of memory to the resource pool. This, in effect, undoes a previous 48H function call. The segment address of the block to be released is placed in ES. When a program is finished, DOS releases only the block of memory originally allocated for that program—an application must explicitly

SMALL WONDER. SMALL PRICE.

GRAPHICS SOLUTION™

\$299⁰⁰

ATI's **GRAPHICS SOLUTION** is a multi-application video adapter that performs high resolution monochrome graphics, high resolution color/graphics and color/graphics emulation. The optional Serial/Parallel Expansion Module adds an RS232C asynchronous serial interface and a parallel printer interface without using an additional slot.



ATI GRAPHICS SOLUTION	ATI GRAPHICS SOLUTION	PARADISE MODULAR GRAPHICS	HERCULES GRAPHICS	PLANTRONICS COLORPLUS
CMOS VLSI Gate Array Technology	✓		✓	
Hercules Compatible Monochrome Graphics	✓		✓	
Color Emulation on Monochrome Monitor	Full screen in 16 shades No pre-boot software	✓ ✓	✓	
High Resolution Color/Graphics	320 x 200, 16 colors 640 x 200, 4 colors 640 x 200, 16 colors	✓ ✓ ✓		✓ ✓
IBM Compatible Color/Graphics		✓	✓	✓
132 Columns in either Color or Monochrome		✓		
Fast Flicker-free Scrolling in all Modes		✓	✓	✓
Serial Port	Opt. *	Opt.		
Parallel Port	Opt. *	Opt.	✓	✓
Warranty	2 YEARS	1 YEAR	2 YEARS	1 YEAR
Suggested List Price	\$299	\$395	\$499	\$559

* SERIAL/PARALLEL EXPANSION MODULE \$79
PARALLEL EXPANSION MODULE \$49

Why stock a whole range of boards when all you need is the **GRAPHICS SOLUTION** by ATI. Call now for more information (416) 477-8804. Distributor and dealer inquiries invited.



450 Esna Park Dr.
Markham, Ontario, Canada
L3R 1H5 (416) 477-8804
TELEX 06-966640 (CMC — MKHM) TECHNOLOGIES INC.

DISTRIBUTORS

UNITED STATES		CANADA	
FIRST SOURCE, Arizona	(602) 437-9744	OSSMAN COMPUTER TECHNOLOGIES INC.	
R.C. DATA, California	(408) 445-0000	IN NY (800) 628-4466	(800) 942-5217
F.A. COMPONENTS, Indiana	(800) 331-7567	IN IL (800) 323-2239	
In In (219) 432-8540	Outside IL (800) 824-9627		
SOFTWARE AMERICA, Maryland	(301) 459-2100	IN OH (800) 824-5934	(800) 221-2314
F.A. COMPONENTS, New York	(800) 847-4148	Outside OH (800) 624-4010	
In N.Y. (718) 507-1444	Outside NJ (416) 477-8088		
F.A. COMPONENTS, S. Carolina	(800) 845-2747	IN NJ (604) 522-9877	(416) 890-2603
In S.C. (803) 288-2422	Outside NJ (800) 772-5340	WELLS DATA, Ontario	
COMPU-D National		SANTRONICS, British Columbia	
In TX			

* Trademarks: Paradise, Modular Graphics Card — Paradise Systems Inc.; Hercules Graphics — Hercules Computer Technology; GraFix Partner — Brightbill-Roberts; Symphony — Lotus Development Corporation; IBM — International Business Machines; Plantronics, Colorplus — Plantronics Enhanced Graphics Corp.

PROGRAMMING PRACTICES

release all other allocated blocks; otherwise the memory contained in those blocks becomes permanently unavailable to any other application (until the system is rebooted), a situation that can cause a system crash.

Function call 4AH (set block) instructs DOS to resize a memory block and make it either larger or smaller. The segment address of the memory block to be resized is placed in ES. The number of paragraphs required in the block after the reallocation is specified in BX. An allocated block can be made smaller by simply freeing a portion of memory in the block and returning that memory to the resource pool. The user must be certain, however, before using the 4AH function call, that the data stored in the released memory are not necessary to any application. An allocated block can be made larger only when sufficient memory is available immediately above the block's upper limit. In the applications below, 4AH is used to release sufficient memory to allow the loading of a subprocess, thus reducing the size of a memory block.

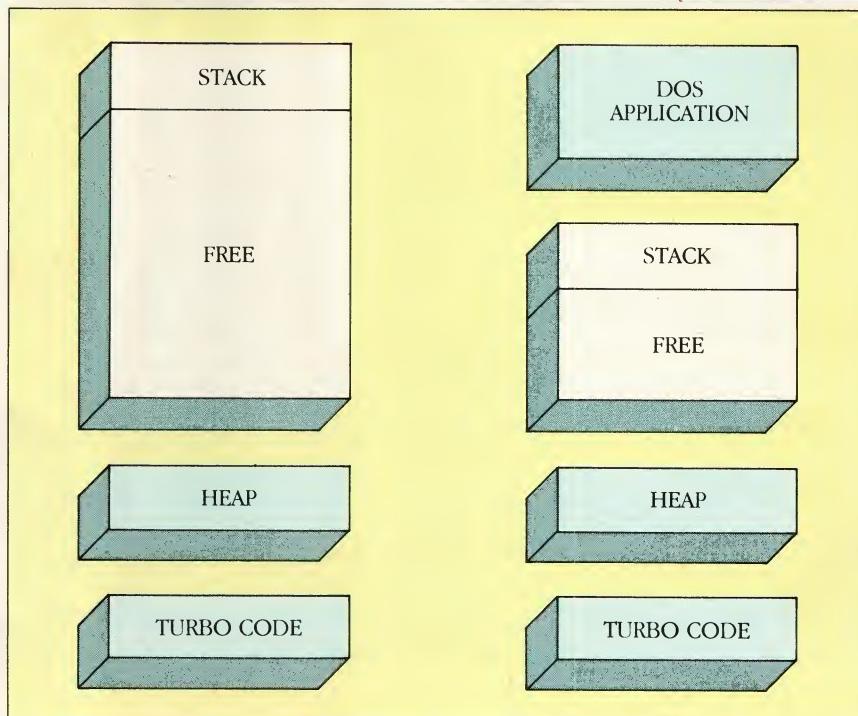
Two DOS function calls are available to execute subprocesses from within programs after 49H or 4AH have been used to release the required memory. As with the calls discussed above, DOS sets the carry flag if it cannot fulfill the request.

Function call 4BH (load and execute a program) instructs DOS to execute a .COM or a .EXE file as if the name of the program had been typed at the DOS prompt: memory is allocated; a PSP is established; the program code is loaded; and the new application is given control of the system. When the new application finishes (by executing an interrupt 20H, by calling program terminate function 00H or 4CH, or by calling terminate process and remain resident function 31H), control is returned to the parent process and processing is continued.

When using function 4BH, the parent process provides DOS with the name of the program to be executed and with a double-word pointer to a 14-byte load control parameter block that DOS can use to construct a PSP for the subprocess. Any files opened in the parent process are available for use by the subprocess; thus, a calling application can specify redirection of standard input and output in the subprocess by setting up the appropriate logical file assignments prior to requesting 4BH.

Unlike other DOS function calls, 4BH does not preserve values in the

FIGURE 1: Making Room for DOS Application



Memory management allows a programmer to reduce the size of Turbo Pascal and make room for a DOS application in high memory. The user can execute DOS commands from a Turbo program then return to the parent application.

registers. An application can preserve the values in most of the registers by pushing their contents onto the 8086 stack before invoking function 4BH. Unfortunately, the values of the SS (stack segment) and SP (stack pointer) registers are altered by 4BH and must be saved in a portion of memory that can be addressed relative to the CS (code segment) register when the parent process resumes processing. If the SS and SP are not saved in this way, the parent process is unable to continue execution when the subprocess finishes, and the system can crash.

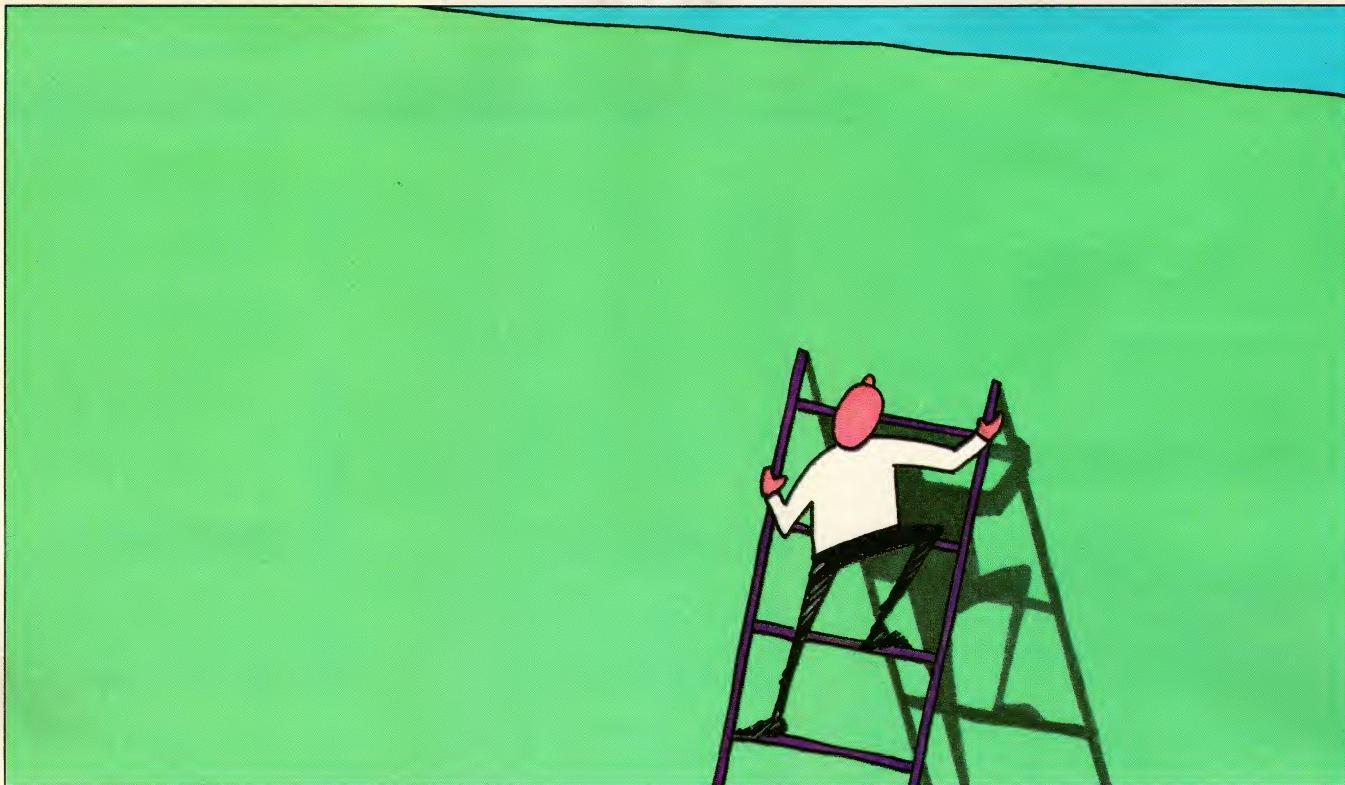
Function call 4DH (retrieve the exit code of a subprocess) allows the parent process to obtain status information back from a subprocess. Programs that terminate using either function 31H or 4CH can return an exit code using the AL register. The only way to query this exit code is to call function 4DH. IBM calls this function *wait*; it is evidently intended for multitasking versions of DOS, in which the subprocess and parent process operate concurrently and 4DH is necessary to ensure synchronization between processes.

INTERFACING TO TURBO

A Turbo Pascal procedure or function that is declared EXTERNAL passes its pa-

rameters on the stack. Parameters can be declared either pass-by-value or pass-by-reference, but only pass-by-reference parameters can be altered by an assembly language subroutine. Extensive documentation of the formats used with pass-by-value parameters appears in chapter 20 of Borland International's *Turbo Pascal Reference Manual*. In short, integer pass-by-value parameters are passed using a full word on the stack, while all pass-by-reference parameters are passed by placing a double-word pointer on the stack. External subroutines access the values or addresses of parameters by using the BP (base pointer) register relative to the SS register; the subroutines that are included in the SPMMLIB.PAS library (which is discussed below) use the Microsoft Macro Assembler's STRUC directive to allow the arguments to be referenced by name. External subroutines must preserve the values in the DS, SS, SP, and BP registers, but the values in other registers can be changed. If an external subroutine is declared a function, it can return a function result, typically by placing the value in the AX register.

The executable code for an external subroutine is included as part of the program's code segment and is invoked by using a near call. Thus, when an ex-



The problem with most 4GLs is they're finished before you are.

And where does that leave you?

With the final, tricky ten percent of your application yet to write, and no 4GL left to write it with.

Introducing INFORMIX®-4GL.

Never again will you have to switch to C or COBOL to truly customize your application. Instead, INFORMIX-4GL provides an all encompassing syntax for every aspect of your application building.

So once you're programming in INFORMIX-4GL, you never have to leave it. And considering all it can do, you may never want to.

Now, for instance, you can write in just ten to twenty pages of 4GL code, applica-

tions that would take hundreds of pages with C.

That's because INFORMIX-4GL was designed from the start to be an application building language. It's built around the full implementation of ANSI Standard SQL. And features Custom Screen Generation, Custom Menu Building and a built-in Report Writer.

What's more, INFORMIX-4GL works with UNIX™, MS™-DOS and Networked DOS operating systems. And, of course, it's compatible with INFORMIX-SQL—our popular, proven DBMS. So files you build with one, you can access with the other.

For more information and our free booklet, "A 20-Minute Guide to INFORMIX-4GL," call 415/322-4100.

Or write RDS, 4100 Bohannon Drive, Menlo Park, CA 94025.

And start taking your applications to even greater heights.



RELATIONAL DATABASE SYSTEMS, INC.

INFORMIX is a registered trademark of RDS. Other names identified by TM are trademarks and/or service marks of their respective manufacturers.
© 1986, Relational Database Systems, Inc.

PROGRAMMING PRACTICES

ternal subroutine is given control, the CS register contains the segment address of the entire Pascal program, not the segment address of the start of the subroutine. This creates problems for external subroutines that require local data storage, because the macro assembler generates address offsets relative to the start of the subroutine. As a result, external subroutines using local data must be able to calculate a relocation factor that, when added to the offsets generated by the assembler, yields the correct offsets relative to the start of the Pascal code segment. One method of calculating this relocation factor uses one of the assembly language functions included in the SPMMLIB.PAS library.

The Turbo subprocess and memory-management library (see listing 1 and table 1) contains six subroutines, each of which can be used to access DOS 2.x and 3.x functions through interrupt 21H. Four of these subroutines are written in Pascal.

The integer function DOS48H provides a direct interface with the DOS 48H (allocate memory) function. This function can be invoked only from a program that has been compiled to a .COM file; if the user attempts to call it from a program compiled directly to

TABLE 1: Memory Management Calls

DOS FUNCTIONS USED DIRECTLY

48H Allocate memory
49H Free allocated memory
4DH Get return code of subprocess

DOS FUNCTIONS USED AFTER STACK SAVED

4AH SETBLOCK: Resize allocated memory blocks
4BH EXEC: Load and execute a program

The memory management library (see listing 1) gives Turbo Pascal users direct access to the DOS functions that are shown above. The library called SPMMLIB.PAS accesses the first three with simple interfaces. SETBLOCK and EXEC cannot be used until assembly language subroutines have saved the stack.

memory, DOS can fail and require that the system be rebooted. The integer function DOS49H provides a similar interface with the DOS49H deallocate memory function; it releases blocks of memory that were allocated for use with DOS48H. Both of these functions return a function result of 0 if DOS completes the request, and the DOS error code if the request fails.

The Boolean function called DOS_ERROR_CHECK is a simple utility that interprets error codes. If passed a value of 0, DOS_ERROR_CHECK returns the function result FALSE; if

passed any other value, this function displays the corresponding error message and returns the function result TRUE. The integer function DOS4DH provides a direct interface with the DOS 4DH retrieve exit code function, and returns the exit code as its function result. The Boolean function called GET_COMSPEC does not relate directly to memory management; its function is discussed below.

The remaining two subroutines are EXTERNAL functions; thus, only their procedure headings are included in the SPMMLIB.PAS library.

Frustrated With the Tyranny of PASCAL? Tired of the Drudgery of BASIC?

Free Yourself With CCSM, the Database Language...only \$59.95

Compare This Routine to Your Present Language, and See the Difference

```
RD  READ "NAME: ",NAM,! QUIT:NAM=""  
    IF NAM'?2.A1","1A.E WRITE "PLEASE ENTER AS LAST, FIRST MI",! GO RD  
TEL  READ "TEL # ",TEL,! IF TEL?'3N1"--"4N WRITE "NNN-NNNN PLEASE",! GO TEL  
    SET ^DATA(NAM)=TEL GO RD  
PRT WRITE "      NAME",?20,"TELEPHONE #",! SET NAME=""  
LP   SET NAM=$ORDER(^DATA(NAM)) QUIT:NAM=""      WRITE NAM,?20,^DATA(NAM),! GO LP
```

AMEX, VISA and
MASTERCARD
accepted by phone.

1-800-257-8052

In Texas 713-529-2576

CCSM, the Database Language, sells for \$59.95, and comes with full documentation. Until March 31, 1986, for an additional \$15.95, we'll send along the "Cookbook of MUMPS", and its disk, (reg. \$24.95) containing useful routines and utilities. For charts and graphs, order the Graphics disk for \$49.95. Multi-user version, \$450. Disks are non-copy-protected. Requires IBM PC or compatible with 128K. (Macintosh version available...\$89.95)

Order by phone, or clip and mail:

1-800-257-8052
in Texas, 713-529-2576

AMEX	— card no. _____	M Global
VISA	—	1601 Westheimer
MC	—	Suite 201
		Houston, TX 77006
		exp. date _____
CCSM, Cookbook, and disks special package \$75.90		
CCSM, the Database Language \$59.95		
Graphics disk \$49.95		
Please add \$3.00 for shipping and handling. Texas residents add 6 1/8% sales tax.		

name _____
street _____
city _____ st _____ zip _____

IBM PC and Macintosh are trademarks of International Business Machines, and Apple Computer.

This simple program accepts, screens and saves names and phone numbers...sorts and prints them. These six lines of code are an example of the extremely compact, and familiar nature of COMP Computing Standard MUMPS, the Database Language. In lines 1 and 2, READ, IF, WRITE and GO should be easy to follow. The pattern match operator "??" filters for the correct input of alpha characters to make a name. In line 4, SET ^ DATA creates a permanent global file, with NAM as a subscript. The data node is SET to the telephone number. In line 6, the \$ORDER command gets the next subscript in order, from the ^ DATA file, thereby SETTING NAM to the next name in the file.

CCSM, the Database Language, frees you from the tyranny of typed and restrictive languages...NO declarations of variables or data files. Look at these Features:

- Full Screen Editor
- Virtual Memory (routines and variables may be as large as a disk)
- Multi-User available..up to 15
- B-Tree File Structure
- 8087 and BCD Support
- Exceeds 1984 ANSI Standard MUMPS
- Transportable from Micro to Mini to Mainframe

CCSM, the Database Language, is a fast, modern version of ANSI Standard MUMPS, developed by COMP Computing. It comes with a 20 year history of development, solving database applications. CCSM improves programmer productivity, and efficiency...typical programs are written in 1/3 the code of BASIC or PASCAL. CCSM is an easy to learn language and comes with a 250 page manual.

CIRCLE NO. 153 ON READER SERVICE CARD

The assembly language program of the integer function DOS4AH is shown in listing 2. DOS4AH attempts to shrink the size of the Pascal program's memory block by the number of paragraphs that are passed in the integer argument PP_TO_RELEASE. If the attempt is unsuccessful, DOS4AH returns the DOS error code in the AX register (the function result), which can be interpreted using the DOS_ERROR_CHECK function. If it is able to release the memory, however, DOS4AH must relocate the

contents of the Turbo Pascal stack and reset the SS register to a place within the boundaries of the now reduced memory block. This step is necessary because compiled Turbo programs, which are .COM files, are allocated all available memory (including all the memory released by 4AH to DOS) and create a runtime stack at the high end of this memory.

The relocated Turbo stack occupies memory that otherwise would have been used for Turbo's heap (the space

allocated to store dynamic variables). Thus, the application calling DOS4AH must be certain that no dynamic variables have been created in the memory space required for the new stack. The best way to guarantee this is to call DOS4AH at the beginning of a program before any heap allocations have been made. After the program is running, Turbo can recognize that its heap space has been reduced and will not attempt to allocate any new dynamic variables to the space occupied by the stack.

DOS4AH can be used only in programs compiled to a .COM file. If invoked from a program compiled directly to memory, DOS4AH fails and returns the error message "memory control blocks destroyed." According to IBM, this leaves the memory allocation system in an unpredictable state, and later can cause a system crash.

The integer function DOS4BH (see listing 3) must be assigned two arguments: a Turbo Pascal string containing the ASCII name of the program to be executed, as well as a Turbo Pascal string containing the unformatted parameter string passed to the program in the PSP. Both of these arguments are declared pass-by-reference in the SPMLIB.PAS library, and only their double-word addresses are placed on the stack. After calculating an offset relocation factor, DOS4BH constructs a load control parameter block. The segment address of the environment is set to 0; the subprocess is given access to the same environment as the parent process. The FCB address fields are ignored and always set to 0. Next, the SS and SP registers are saved locally, and function 4BH is invoked, which starts the subprocess. After the subprocess terminates, DOS4BH recalculates the relocation factor, restores the SS and SP registers, places the error code or 0 in the AX register, and returns to the calling Turbo Pascal program.

EXECUTING DOS FROM TURBO

Listing 4 shows the Turbo Pascal source code for the program DOSCOM.PAS. The program is straightforward: it uses the SPMLIB.PAS library to read DOS commands from the keyboard and, by executing a secondary copy of the DOS command processor, is able to act on those commands as if they had been entered at the DOS prompt. Any DOS commands can be executed, even those that invoke other applications programs. If necessary, DOS is even able to search for a required program using the PATH specification in the DOS environment.

C PROGRAMMERS

THE BEST JUST GOT MUCH BETTER

The Greenleaf Functions v3.0 Is Bigger and Better!

Over 225 functions — DOS, disk, video, graphics, string, time/date, equipment determination to name only a few. New disk status and Ctrl-Break control functions! Exciting new features include automated installation, all memory model library files now supplied, identifier length options supported, and more. Twenty new functions added in v3.0! Don't re-invent the wheel; get your copy today!

The Greenleaf Comm Library v2.0 is Here Now!

Over 120 all new functions — interrupt driven communications on up to 16 ports simultaneously, XMODEM, XON/OFF, send and receive with confidence that only this fully buffered system brings. New easy installation, all memory models, new Ctrl-Break immunity, keyboard functions, lots more. All new manual and demos. Many examples make it easy to use, too!

Both available now from your dealer or Greenleaf Software, Inc.

Greenleaf Comm Library v2.0	\$185
Greenleaf Functions v3.0	\$185
Lattice C Compiler v3.0	\$395
Microsoft C Compiler v3.0	\$295
Computer Innovations C86	\$349
Mark Williams MWC86	\$475

Add \$5.00 per unit for ground shipping.

Master Card, VISA accepted.



All libraries contain full source code, complete professional documentation with many examples, applications and function selection information, a reference card, access to bulletin board, and a subscription to *The Greenleaf Chronicles* newsletter. There are no royalties. All prices subject to change.

For more information call:

Greenleaf Software, Inc.

2101 Hickory Drive
Carrollton, TX 75006
214/446-8641



\$1,000 + for a tape backup or \$179 for Fastback

the choice is yours...

**The only difference
is, FASTBACK* is
faster and better!**

It's true.

In test after test, FASTBACK consistently outperforms tape backup systems costing well over five times its meager price. What's more, FASTBACK does it better, because it's fully file-oriented (not a "disk image"). It's easy to learn and use; it requires nothing but your own IBM PC/XT/AT™ or compatible to run!

Just take a look at the chart on the right. You'll see why over 30,000 satisfied users have chosen FASTBACK over expensive tape systems (or slower FASTBACK imitations)...and why *PC Tech Journal* named it "Software Product of the Month."

Now you can back up *every* bit of information, on every computer in your home or office, *every* day. And sleep better every night.

Staple your backup disk.

FASTBACK's advanced error correction capabilities are so sophisticated, you can actually drive a staple right through your backup disk...and not lose a single byte of data. Try *that* with an expensive tape system!

In fact, FASTBACK is just about "goof-proof." If your diskettes need formatting, FASTBACK does it for you, automatically. If you get your disks mixed up and attempt to overwrite data you've already saved, FASTBACK warns you. And FASTBACK will completely catalog your saved data so you can find what you're looking for in a flash.

	PRICE	FILE BACKUP	IMAGE BACKUP
FastBack 1.2MB	\$179.	3:47	N/A
FastBack 360K	\$179.	8:12	N/A

TAPE DRIVE

Everex Excel	\$1695.	31:20	2:24
Express Sys/ Orion	\$1,295. \$1,555.	20:58	2:39
Sygen QIC-FILE	\$1,495.	21:37	2:47
Sigma Designs Streaming Tape	\$1,595.	10:38	2:48
Kameran Labs Masterflight	\$1,795.	4:49	2:51
Tecmar QIC-60	\$2,144.	10:53	3:55
Mountain File Safe ²	\$2,395.	N/A	5:20
Maynard Maynstream 60	\$1,595	6:27	N/A
Cipher Floppy/Tape	\$1,095 /XT \$1,195 /AT	11:48	N/A
MicroSystems MT25	\$1,050.	11:59	N/A
Tallgrass TG-4060	\$1,995.	35:06	12:55
Alloy P C QICTAPE	\$2,995.	24:30	N/A
Adic Model 552	\$3,900.	25:43	N/A
Data Technology TeamMate	\$1,695.	26:48	-1

[†] All times are given in minutes:seconds.

Don't be half-fast.

FASTBACK's phenomenal speed has become a legend in its own time, because it *will* back up a full 10-megabyte hard disk in just 8 minutes flat...even allowing ample time to change diskettes. But that's only half the story, because FASTBACK runs over twice as fast on the IBM PC-AT. For crucial business

applications and huge volumes of data, FASTBACK will save the AT's full 20-megabyte disk in the same 8 minutes!

Here's what the experts say:

"It is difficult to imagine how a disk back-up program might perform more efficiently than this... Fastback is a most elegant solution to the knotty problem of fixed-disk backup for the PC."

—Jeff Dunteman
PC Tech Journal
Product of the
Month pg. 31
October 8, 1985

"The best new program I saw at NCC was Fastback..."

—Jerry Pournelle
Byte Magazine
Nov., 1985 Vol.
10, No. 12

We'll even give you the disks... FREE!

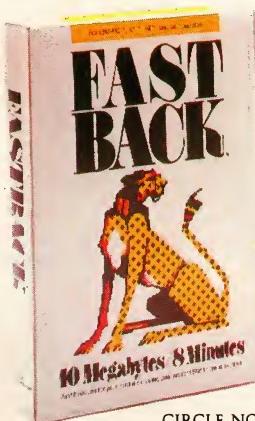
FASTBACK works with any size hard disk running on any IBM PC or compatible (requires PC-DOS™ or MS-DOS™ Version 2.0 or higher). There's nothing else to buy, no expensive add-on boards or peripherals to take up expansion slots, no bulky equipment to take up valuable space in your work area. And for a limited time, we'll even give you the disks you need, absolutely free! Just clip out the coupon below and send it along with your proof of purchase and FASTBACK registration card. We'll send your choice of 20 (360K) or 10 (1.2 megabyte) certified error-free diskettes by return mail, at our expense.

So don't risk losing important programs or data another day. And don't spend \$1000 or more on an expensive tape dinosaur. Get smart. Get FASTBACK. Today.

† All times are given in minutes:seconds. ¹Although the TeamMate promised image backup and restore, the image backup option did not work. Therefore, neither of the image options were timed. ²The Mountain would not work on the standard test machine. Its benchmarks were obtained by connecting it to a PC with a 20 MB Microsense hard disk (which contained 10 MB of data). Fastback time test was conducted by Fifth Generation Systems. Tape Drive table is an excerpt from *PC Tech Journal*, November 1985 Issue, page 73. Copyright © 1985 Ziff-Davis Publishing Company. These test measure each drive's performance when executing a series of standard tape operations. N/A means that the tape drive does not support that operation.



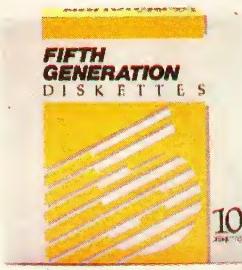
Marketing and Sales: 909 Electric Avenue, Suite 202, Seal Beach, CA, 90740; Manufacturing: 7942 Picardy Avenue, Baton Rouge, LA, 70809; Telephone: 1-800-225-2775 or (213) 493-4483



CIRCLE NO. 217 ON READER SERVICE CARD

*This product is in no way associated with or has origin in Fisher Scientific or Allied Corporation. IBM-PC, IBM-XT, IBM-AT and PC-DOS are registered trademarks of International Business Machines Corporation. MS-DOS is a registered trademark of Microsoft, Inc.

Marketing and Sales by CSSL, Inc.



Introductory
Offer

Offer Expires:
March 31, 1986

I need:
 20 (360K) diskettes or
 10 (1.2 MB) diskettes

FASTBACK

Fast hard disk backups for your MS-DOS™ system.



Fastback (Version 5.0) for the IBM PC/XT/AT or compatibles is the hard disk backup and restore software utility that eliminates the need for expensive tape backup.



Coupon with proof of purchase and registration card should be sent to: Free Diskettes Offer, Fifth Generation Systems, 7942 Picardy Avenue, Baton Rouge, LA, 70809; Telephone: 1-800-225-2775 or (213) 493-4483.

Send in this coupon with your proof of purchase and registration card to receive your FREE Diskettes. (Offer applies only to purchases made after January 1, 1986). Suggested Retail Price: \$179.

Name: _____

Shipping Address: _____

City: _____

Zip: _____

State: _____

Telephone: () _____

In addition, commands can include DOS input- and output-redirection characters. If a command results in a change in the DOS environment with, for example, a PATH command, the change remains in effect only until control is returned to DOSCOM.PAS.

DOSCOM.PAS uses the DOS48H function to check for the availability of sufficient unallocated memory. Sufficient memory probably is available if the Pascal program was compiled with the upper limits set on the size of its

heap/stack segment. If adequate memory is not available, the DOS4AH function is called to release sufficient memory and relocate the stack. When the required amount of memory is made available, DOSCOM.PAS enters a loop: it reads a command from the keyboard, loads COMMAND.COM (the DOS command processor); and passes it the command to be executed. This loop continues until **bye** is entered as the DOS command, then the memory allocated to COMMAND is freed.

Before it is able to load the COMMAND.COM program, DOSCOM must find it. GET COMSPEC (mentioned above) searches the COMSPEC specification in the DOS environment (segment address at offset 2CH in the parent process's code segment) and tries to locate the D:[path]filename of the command processor. The pass-by-reference argument of this function is the name of a string that contains the ASCIIZ file name. COMSPEC returns FALSE if no problems arise in its search and TRUE if it is unable to locate the COMSPEC=string in the environment.

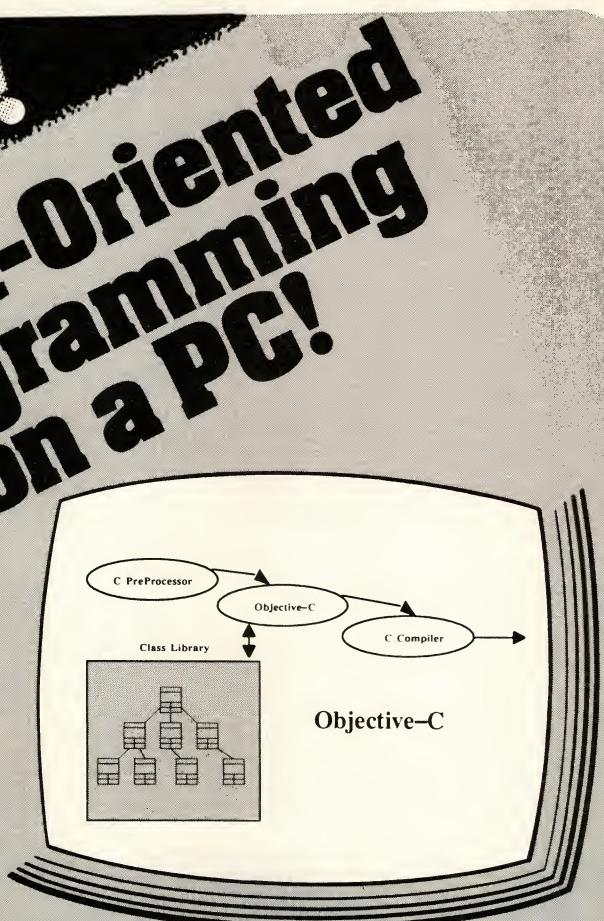
Note that one of SPMLIB's routines is not used in DOSCOM. As a further refinement, the exit code for the executed DOS command could be obtained by a call to DOS4DH after the DOS4BH function is finished.

The DOS command to be executed is passed to DOS4BH as a Pascal string preceded by /C (see *DOS 3.1 Reference Manual*, pp. 7-53) and followed by a carriage return. Approximately 27KB of memory must be released: 23KB for the DOS 3.1 command processor and 4KB for overhead. If the command passed to DOS calls for the execution of some other .COM or .EXE program, enough memory must have been released to allow the program to run.

APPLICATIONS

Effective memory management in Turbo Pascal allows a host of useful applications for both programmers and end users. The SPMLIB.PAS library and the DOSCOM.PAS code shown in listing 4 can be incorporated into any Turbo program to allow the user to invoke DOS commands directly. Output redirection provides more opportunities: DIR output can be redirected to a file, read from Pascal, and manipulated internally. Programmers can use Turbo to create quick memory-resident programs or DOS shells; in the past, users believed that only C and assembly language could perform such tasks.

Users should note that both the SPMLIB.PAS library and the program called DOSCOM.PAS were written to run under version 2.1 of DOS. They will function exactly the same under 3.x, with one exception: because the COMMAND.COM is larger in DOS 3.x, a larger memory block must be released in DOSCOM.PAS.



Objective-C™ is an object-oriented programming language and a fully documented library of reusable components...adding messages, objects and inheritance to C language. Applications written in Objective-C are fully compatible with other Objective-C compilers running under UNIX, VMS or AOS.

Objective-C provides the productivity of object-oriented programming, while

retaining the portability and efficiency of C. PPI also provides comprehensive technology transfer to insure that your programmers fully understand this exciting new technology.

PPI's Objective-C compiler generates C code, which requires the Microsoft V3 C compiler running under MS/DOS.

At \$500 Objective-C is affordable. Order today!



PRODUCTIVITY PRODUCTS INTERNATIONAL
27 Glen Road, Sandy Hook, CT 06482. (203) 426-1875.



CIRCLE NO. 219 ON READER SERVICE CARD

David D. Steiner, Ph.D., is an assistant professor of economics at the University of North Carolina at Chapel Hill. He has been programming for the past 16 years.

Powerful MS-DOS™ Software.

For the IBM®-PC, XT, AT & others with generic MS-DOS/PC-DOS 2.0 or higher.



Only **\$39.95** Each!

UTAH **COBOL™**

Whether student, teacher or professional programmer, this is the one you've heard so much about.

- It's easy to use. Compiles 5000 statements on a 128K machine.
- 170 clear error messages, i.e. DATA-NAME IS MISSING OR MISSPELLED.
- Distribute your object code programs royalty free.
- Small object code programs conserve disk space.
- Fast compile times to increase programmer productivity. Over 25 times faster than one compiler costing \$995!
- You get a diskette and 213-page manual with lots of examples and 16 complete COBOL source code programs. **\$39.95**.

Also available: COBOL Application Packages, Book 1 **\$9.95**.

UTAH **PASCAL™**

- 14-digit precision, BCD math, no round-off errors with decimal arithmetic for business and floating point +63 – 64 for scientific.
- A very nice TRACE style debugging.
- Arrays up to 8 dimensions and 64K strings.
- External procedures and functions with dynamic auto-loading.
- One-step compile, no assembly or link required.
- You get a 132-page manual and diskette. **\$39.95**.

UTAH **PILOT™**

- Perfect for industrial training, office training, drill and testing, virtually all programmed instruction, word puzzle games, and data entry facilitated by prompts.
- John Starkweather, Ph.D., the inventor of the PILOT language, has added a built-in full-screen text editor, and much more.
- Meets all PILOT-73 standards for full compatibility with older versions.
- You get a diskette, 125-page manual and ten useful sample programs. **\$39.95**.

Also still available for 8-bit machines with CP/M® is our world famous Nevada Software Series used by 50,000 customers in 40 countries. These include Nevada COBOL, Nevada FORTRAN, Nevada PASCAL, Nevada PILOT, Nevada BASIC and Nevada EDIT. **\$39.95** each.

Satisfaction guaranteed. If for any reason you're not completely satisfied, just return the package within 15 days in good condition, and we'll refund your money.

IBM is a registered trademark of International Business Machines Corp. CP/M is a registered trademark of Digital Research. MS is a trademark of Microsoft Corp. © 1985 Ellis Computing, Inc.

UTAH **FORTRAN™**

- FORTRAN IV based upon ANSI-66 standards.
- Very fast compile times and easy to use.
- IF . . . THEN . . . ELSE constructs.
- Chaining with blank and named common.
- Copy statement.
- ENCODE and DECODE.
- Free-format input and output.
- A very nice TRACE style debugging.
- 150 English language error messages.
- You get a diskette, and 223-page manual. **\$39.95**.

UTAH **EDIT™**

- A character-oriented full-screen video display text editor designed specifically to create COBOL, FORTRAN and PASCAL programs.
- Only requires 15K disk space so it can fit on the same disk as your compilers.
- Completely customizable tab stops, default file type, keyboard control key layout and CRT by menu selection.
- Diskette comes with easy to read 58-page manual. **\$39.95**.

UTAH **BASIC™**

- This interpreter has a built-in full-screen editor.
- Single- and Multi-line user definable functions.
- BCD Math- no round-off errors.
- Full Matrix operations.
- You get 220-page manual and diskette. **\$39.95**.

Handling/Shipping: No shipping charge within US. Overseas add \$10 for first package, \$5 each additional. Checks must be in US Dollars, drawn on a US bank.

Utah Software requires 128K RAM and PC-DOS or MS-DOS 2.0 or higher.

HOW TO ORDER. Send check or money order to Ellis Computing, Inc. with VISA or MASTERCARD order by phone. Sorry no COD's.



Ellis Computing, Inc.
5655 Riggins Court, Suite 10
Reno, Nevada 89502
Phone (702) 827-3030

SINCE 1977



ELLIS COMPUTING™

PROGRAMMING PRACTICES

LISTING 1: SPMLIB.PAS

```

{-----}
{ SUB-PROCESS AND MEMORY MANAGEMENT LIBRARY }
{-----}
type
  r8086=
    record
      ax,bx,cx,dx,bp,di,si,ds,es,flags:integer;
    end;
  asciiz:string[65];

var regs:r8086;

{ ----- REDUCE MEMORY ALLOCATION }
function dos4AH(pp_to_release:integer):integer;
  external 'dos4AH.com';

{----- EXECUTE A SUB-PROCESS }
function dos4BH(var program_name,parameter_string):integer;
  external 'dos4BH.com';

{----- ALLOCATE A NEW MEMORY BLOCK }
function dos48H(pp_needed:integer;var block_segment:integer):integer;
begin
  regs.bx:=pp_needed;           { # of paragraphs required. }
  regs.ax:=$48 shl 8;          { Function call 48H. }
  msdos(regs);                 { Call DOS. }
  if (regs.flags and 1)>>0 then { Is carry flag set? }
    begin
      block_segment:=regs.ax; { Yes, return available pp's. }
      dos48h:=lo(regs.ax);    { and error number. }
    end
  else
    begin
      block_segment:=regs.ax; { No, return segment address. }
      dos48h:=0;               { and error code 0 }
    end;
end;

```

```

{----- RELEASE A MEMORY BLOCK }
function dos49H(block_segment:integer);

begin
  regs.es:=block_segment;       { Segment address to release. }
  regs.ax:=$49 shl 8;          { Function call 49H. }
  msdos(regs);                 { Call DOS. }
  if (regs.flags and 1)>>0 then { Is carry flag set? }
    dos49H:=lo(regs.ax);        { Yes, return error number. }
  else
    dos49H:=0;                  { No, return error code 0. }
end;

{----- OBTAIN A PROCESS'S EXIT CODE }
function dos4DH:integer;

begin
  regs.ax:=$4d shl 8;          { Function call 4DH. }
  msdos(regs);                 { Call DOS. }
  dos4dh:=lo(regs.ax);         { Return Exit Code. }
end;

{----- GET COMMAND PROCESSOR NAME }
function get_comspec(var comspec:asciiz):boolean;

type
  dos_env_type=array[1..254] of byte;
  dos_env_string='dos_env_type';

var
  dos_env:dos_env_string;
  dos_envs:string[255];
  idx:integer;

begin
  get_comspec:=false;
  dos_env:=ptr(memw[cseg:$2c],$0); { Get 254 bytes of the DOS }
  move(dos_env^,dos_envs[1],254); { environment string. }
  dos_envs[255]:=#0;

```

A Full C Compiler
For \$49.95



New Release 4.1



The Ecosoft Eco-C88 compiler for the 8088 and MSDOS is going to set a new standard for price and performance. Consider the evidence:

Compiler	Eco-C88	Lattice (1)	C86 (1)
Seive	13	11	13
Fib	44	58	46
Deref	13	13	-
Matrix	21	29	27
Price	\$49.95	\$500.00	\$395.00

(1) Computer Language, Feb., 1985, pp.73-102. Reprinted by permission.
Eco-C88 Rel. 2.83, on IBM PC with 2 floppy disks, 256K. Benchmarks from Feb., 1985 Computer Language.

Eco-C88 includes:

- * All operators and data types (except bit fields)
- * Error messages in English with page numbers that reference the C Programming Guide - a real plus if you're just getting started in C.
- * Over 180 library functions, including color and transcendental
- * New Library functions for treating memory as a file
- * User-selectable ASM or OBJ output (no assembler required)
- * 8087 support with 8087 sensed at runtime
- * cc and "mini-make" for easy compiles (with source)
- * Fast, efficient code for all IBM-PC, XT, AT and compatibles using MSDOS 2.1 or later.
- * Complete user's manual

If ordered with the compiler, the C library source code (excluding transcendental) is \$10.00 and the ISAM file handler (as published in the C Programmer's Library, Que Corp) in OBJ format is an additional \$15.00. Please add \$4.00 for shipping and handling. To order, call or write:

Ecosoft Inc.

6413 N. College Avenue
Indianapolis, IN 46220
(317) 255-6476 8:30-4:30

1-800-952-0472
(orders only)

CIRCLE NO. 131 ON READER SERVICE CARD

We've continually improved Microstat since it was introduced in 1978, and the latest release includes many new features you've wanted.

Interactive and Batch Processing

Data sets that can exceed memory

Expanded Data Management
Subsystem with New Data
Transforms

Multiple Regression (including
Stepwise)

Reading data files created by other
programs (e.g., Lotus)

Scatterplots (including best fit
regression)

3 types of Analysis of Variance

Correlation Analysis

Time Series

12 Nonparametric tests

Crosstabs and Chi-Square

8 Probability Distributions

Factorials, Permutations, and
Combinations

Descriptive Statistics

Hypothesis Tests

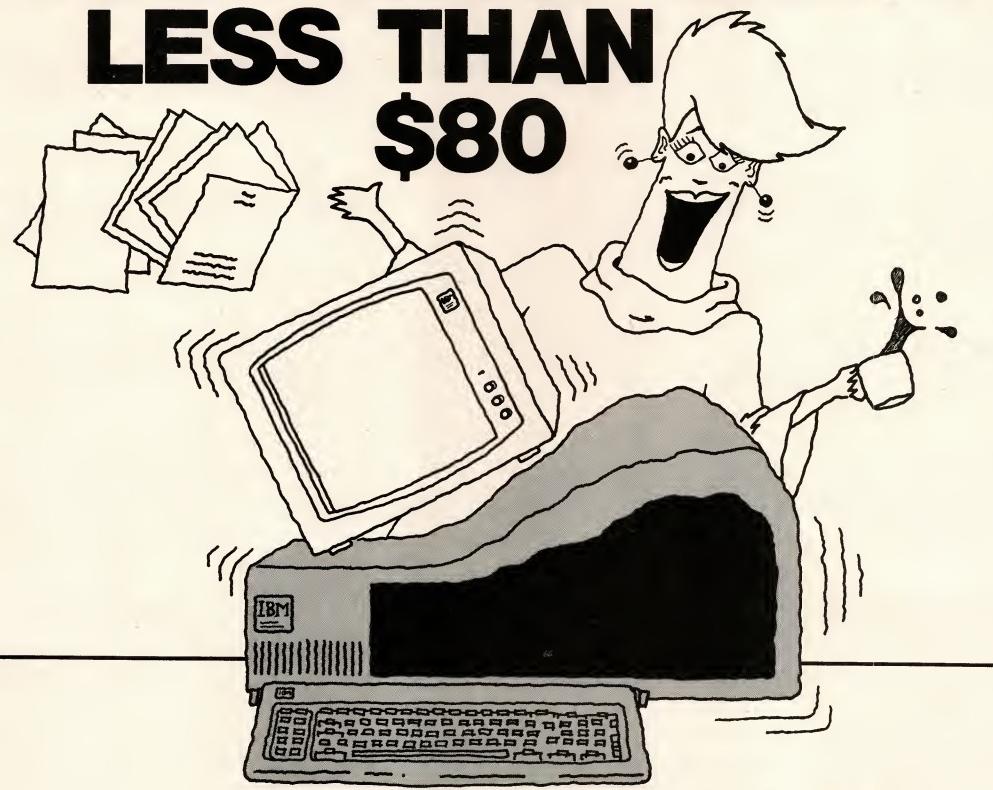
Easy Installation

Microstat's algorithms have been designed to prevent numeric overflow errors and yield unsurpassed accuracy. Microstat's price is \$375.00 including the user's manual and is available for the Z80, 8086, 8088 CPU's and CP/M80, CP/M86, MS-DOS, and PC-DOS. To order, call or write.



Trademarks: Eco-C88, Microstat (Ecosoft), CP/M (Digital Research), MSDOS (Microsoft), PC-DOS (IBM), Z80 (Zilog), 8086, 8087, 8088 (Intel).

DOUBLE THE SIZE OF YOUR HARD DISK FOR LESS THAN **\$80**



WITH ARKIVE.TM

You need more space.

Remember when your 10MB hard disk seemed to have an unlimited amount of storage space? You really used your computer and created budgets, letters, and financial plans. Now, those important files have filled up your disk, and you need more space.

Until now, the only way to get more space was to buy a larger — more expensive — hard disk.

A cheaper way to get more space.

Install ARKIVE™ from Guaranteed Software. ARKIVE frees up your current disk by automatically moving obsolete, stale, and unused files off to archive storage. With yesterday's files archived safely away, you'll have the space you need on your hard disk.

Gone, but not forgotten.

But the best part of ARKIVE isn't automatic archival. It's being able to quickly find — and retrieve — any file you want. There's no need to remember file names, either. ARKIVE can find files based on subject, dates, and other data. You can say "I want that proposal I wrote last summer to the Acme Widget Co." ARKIVE will find it in a jiffy.

How ARKIVE works.

ARKIVE is a resident program that automatically and transparently maintains a database of file information. On a periodic basis, you invoke a "clean up"



Mail order coupon to:
GUARANTEED SOFTWARE
10044 S. De Anza Blvd.
Cupertino, CA 95014
(408) 973-8565

24-Hour Order Lines
(800) 232-7222 [USA]
(800) 331-6223 [Calif]

Yes! Instead of spending hundreds or thousands on a larger hard disk, I want to order ARKIVE for only \$79.95. Shipping & handling is \$5.00 (California residents add 6.5% sales tax of \$5.20).

I'm paying by: Check Visa MasterCard.

Exp. date. _____

Name. _____

Address. _____

City. _____

State/Zip. _____

POs accepted only for quantity orders of 5 units or more. Outside USA: Add \$10.00 and make payment by bank draft payable in US Dollars drawn on a US bank.

Dealers, call for terms and pricing.

SYSTEM REQUIREMENTS: IBM®PC, XT, AT and compatibles. 64KB memory needed for resident program. 128KB memory needed for "cleanup" mode. DOS 2.0 or later.

CIRCLE NO. 110 ON READER SERVICE CARD

Arkive and Guaranteed Software are trademarks of Guaranteed Software. IBM, XT, and AT are trademarks of the International Business Machines Corporation.

PROGRAMMING PRACTICES

```

dos_envs[0]:=#255;
idx:=pos('COMSPEC=',dos_envs); { Find COMSPEC= portion. }
if idx=0 then { Yikes! No COMSPEC= there! }
begin
writeln('*** "COMSPEC=d:[path]filename" not in DOS environment.');
get_comspec:=true;
exit; { Return TRUE. }
end;
else
begin
delete(dos_envs,1, idx+7); { Isolate the ASCIIZ string }
idx:=pos(#0,dos_envs); { drive:[path]filename }
dos_envs:=copy(dos_envs,1, idx); { of the command processor.}
while dos_envs[1]='#' do
  delete(dos_envs,1,1);
comspec:=dos_envs; { Return FALSE. }
end;
end;

{----- HANDLE A DOS ERROR CONDITION }
function dos_error_check(error_code:integer):boolean;

type
  error_table_type = array [1..18] of string[41];

const
  error_table: error_table_type = { RANGE: 1 TO 18 DECIMAL }
  ('Invalid function number',
  'File not found',
  'Path not found',
  'Too many open files (no handles left)',
  'Access Denied',
  'Invalid file handle',
  'Memory control blocks destroyed',
  'Insufficient Memory',
  'Invalid memory block address',
  'Invalid environment',
  'Invalid format',
  'Invalid access code',

```

```

'Invalid data',
'UNRECOGNIZED ERROR', { NOT USED BY DOS }
'Invalid drive was specified',
'Attempted to remove the current directory',
'Not same device',
'No more files';

begin
dos_error_check:=true;
if error_code=0 then
  dos_error_check:=false
else
writeln('*** DOS error ',error_code,': ',error_table[error_code]);
end;

```

LISTING 2: DOS4AH.ASM

```

code      segment
assume    cs:code
; FUNCTION called from Turbo Pascal, which releases
; PP_TO_RELEASE paragraphs of memory from the current
; memory block using the DOS function 4AH. If this is
; possible, then the Turbo stack is relocated to the high
; end of the new allocation and function result is zero.
; Otherwise the DOS error code is returned.

; Pascal declaration:
; FUNCTION DOS4AH(PP_TO_RELEASE:INTEGER):INTEGER;

arguments struc
save_bp    dw    ?
ret_adr   dw    ?
pp_to_release dw ? ; INTEGER # of paragraphs
; to release.

;----- arguments ends
dos4ah    proc    near

```

BLAST®

WANG
Data General
AT&T
PRIME
HARRIS
Apple

IBM
digital
HEWLETT PACKARD
MS-DOS
CP/M
UNIX

PC-MINI-MAINFRAME COMMUNICATIONS SOFTWARE

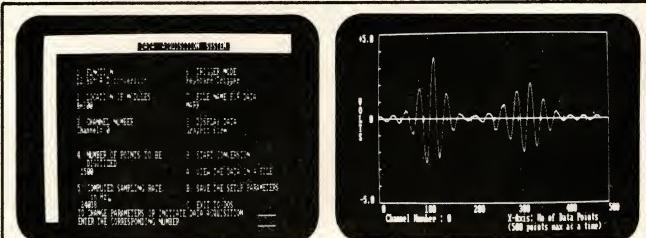
ANY COMPUTER WITH BLAST CAN TALK TO ANY OTHER COMPUTER WITH BLAST, the universal file transfer utility linking many different computers, operating systems, and networks, via RS 232 serial ports.

NO ADD-ON BOARDS TO BUY! **BLAST** software uses any asynchronous modems or direct connect for fast, error-free data transfer through noisy lines and PBXs, across LANs, and over satellites or packet switched networks.

THE PERFECT LOW-COST LINK FOR PC's, MINIS, MAINFRAMES Transfer binary or text files, or executable commands. Use **BLAST** standalone, or built it into your application.

\$250/Micros \$495-895/Minis \$2495/up Mainframes

COMMUNICATIONS RESEARCH GROUP (800)-24-BLAST
8939 Jefferson Hwy. Baton Rouge, LA 70809 (504)-923-0888



MODULAR DATA ACQUISITION SYSTEM

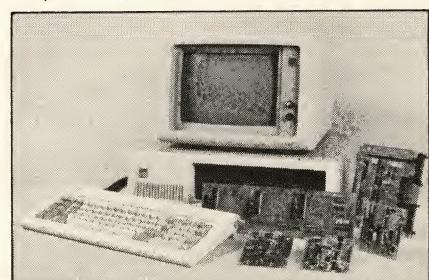
We Bring Engineers, Scientists And The IBM-PC Together. Our unique high-performance modular data acquisition system allows you to purchase the configuration that exactly meets your requirements.

8-BIT A/D SYSTEM

\$490

12-BIT A/D SYSTEM

\$690



QUA TECH, INC.

478 E. Exchange St. Akron OH 44304
(216) 434-3154 TLX: 5101012726

JLASER

LASER PRINTER THE SOLUTION

Fancy Font on the Tall Tree JLASER

Impact Your Laser

Fancy Font combines with the Tall Tree JLASER printer to provide true typeset quality print with the IBM personal computer. Special features include: a large variety of type styles and sizes, font editing capability, powerful formatting commands, kerning and automatic ligature formation. Fancy Font can set up an entire page of text at full 300 dots per inch resolution.

Font Variety

SoftCraft's
*Fonts Are
Available
In Many Different Styles
And
Sizes*

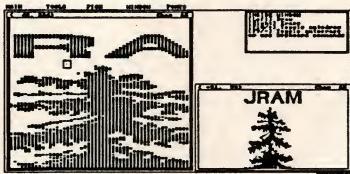
Formatting Power

Special formatting commands that deal with proportional fonts and different height fonts help in setting tables and math formulas. The following equation is an example using fonts from the SoftCraft font library.

$$\pi(n) = \sum_{k=2}^n \left\lfloor \frac{\phi(k)}{k-1} \right\rfloor$$

Logo Creation

The font editing program allows you to edit characters in existing fonts or create new characters or logos from scratch. Logos can be created and then printed just as any other character. An optional font editing program provides an enlarged display, powerful editing commands and is compatible with the Microsoft Mouse. The following screen depicts a character editing session.



Your Options

Fancy Font: Use with any word processor. Create an ASCII file and use Fancy Font formatting commands.

Fancy Word: Use with Microsoft WORD. All of WORD's formatting commands are supported; no other commands are required.

CALL 1-800-351-0500
222 State Street, Madison, WI 53703
(608) 257-3300

SoftCraft, Inc.

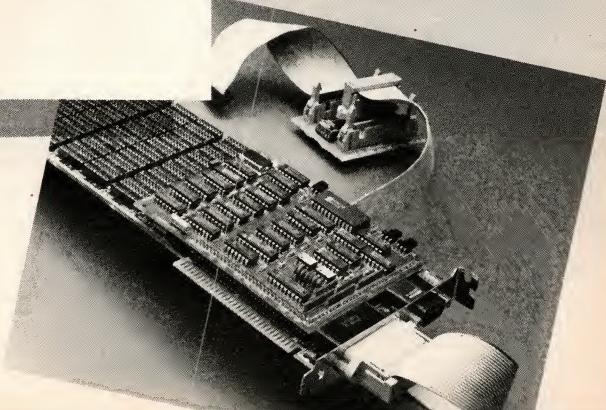
When we introduced JLASER, we knew it was the ultimate solution to current laser printer limitations. Like all good things, it's catching on fast. The list of software companies that back JLASER is expanding rapidly. We are pleased to welcome this latest addition to our growing software family of JLASER supporters.

JLASER is a controller that piggybacks onto a JRAM-3 or AT-3 two megabyte memory board giving laser printers the speed and versatility they were meant to have. It plugs directly into the printer engine of the H-P Laserjet™ or other Canon-based printers. Our interface transfers bit-mapped images from RAM, bypassing the on-board print buffer and most of the control circuitry. It opens up a creative new world of graphics and multiple type font combinations, and still gives you plenty of RAM to use for programs, data, and electronic disk.

JLASER is the powerful, economical, and efficient solution to all your laser printer problems.

CIRCLE NO. 197 ON READER SERVICE CARD

TALL TREE SYSTEMS
1120 San Antonio Road
Palo Alto, CA 94303
(415) 964-1980



PROGRAMMING PRACTICES

```

push    bp
mov     bp,sp      ; Establish access to arguments
push    ds          ; Save Turbo's data segment.

mov     ax,cs      ; Calculate the paragraph size
mov     bx,ss      ; of the current block as
add    bx,1000H   ; SS+1000H minus code segment
sub    bx,ax      ; address. Then calculate new
                 ; size for memory block.

sub    bx,[bp].pp_to_release
mov     es,ax      ; Segment address of current
mov     ah,4ah     ; memory block.
int    21h        ; Ask DOS to deallocate the space.
mov     ah,0        ; exit
jc     exit        ; Was it possible to release
                 ; the memory?

mov     ax,ss      ; Yes: set up to relocate stack
mov     ds,ax      ; DS:SI is pointer to old stack
sub    ax,[bp].pp_to_release
mov     es,ax      ; ES:DI is the pointer to
mov     bx,sp      ; the new stack.
mov     di,bx
mov     si,bx

mov     cx,sp      ; Two's complement of SP
neg    cx          ; is stack size.
cld
rep    movsb      ; DS:SI to ES:DI ...
                 ; starting with the lowest byte
mov     ss,ax      ; Change the SS register ...
xor    ax,ax      ; and set the error code to 0.

exit:  pop    ds
pop    bp
ret    4          ; Pop argument and
                 ; "function result".
dos4AH
code
ends
end

```

LISTING 3: DOS4BH.ASM

```

code     segment
assume   cs:code

; FUNCTION called from Turbo Pascal, executes .COM
; or .EXE programs using the DOS function 4BH.
; Preserves the stack registers, returning the
; error code 0 if successful or the DOS error code
; if the execute fails.

; Pascal declaration:
; FUNCTION DOS4BH(VAR PROGRAM_NAME,PARAMETER_STRING):INTEGER
arguments struc
save_bp    dw    ?
ret_addr  dw    ?
param_str dd    ?           ; DWORD pointer to param. string.
prog_name dd    ?           ; DWORD pointer to ASCIIZ
                             ; program name.
arguments ends

dos4BH    proc    near
          jmp    short exec_code
;----- LOAD CONTROL BLOCK -----
lcb_envir dw    0          ; Segment address of environment
lcb_ps_o  dw    ?          ; Offset of parameter string.
lcb_ps_s  dw    ?          ; Segment of parameter string.
lcb_fcb1 dd    0          ; Dword pointer to FCB1
                         ; (5CH in PSP).
lcb_fcb2 dd    0          ; Dword pointer to FCB2
                         ; (6CH in PSP).
;----- LOCAL VARIABLES -----
ss_save   dw    ?          ; Saved stack segment.
sp_save   dw    ?          ; Saved stack pointer.
;----- LOCAL VARIABLES -----
exec_code: push   bp
           mov    bp,sp      ; Establish access to arguments.

```

NOW
for Microsoft
C version 3.0

the source debugger for lattice C

Your time and convenience come first! The MSD C Debugger™ is the last, and perhaps final, word in programming assistance for Lattice C users. C Debugger produces a high level view of C programs via function names, line numbers, variable names and C data types, plus a low-level view of machine addresses and instructions for testing assembler language functions.

More features include:

- All documentation is prepared for programmers.
- Online help screen throughout the process.
- Capability to single step through your program.
- Set break points, examine registers and variables.

\$165.00 + \$3.50 shipping



To order, call or write:

MICRO-SOFTWARE DEVELOPERS, INC.
214½ W. Main St. • St. Charles, IL 60174
312/377-5151
Lattice C is a trademark of Lattice, Inc.
Microsoft is a trademark of Microsoft Corp.

CIRCLE NO. 213 ON READER SERVICE CARD

THINKING...

ABOUT SOFTWARE COST ESTIMATING?



Consider SWCost, a quick, accurate way to estimate the cost of developing new software. SWCost's parametric model estimates the time, effort and staff needed for the development — and tells you the confidence you may have in completing the work on-time and within budget.

• EASY TO USE —

Your answers to the on-screen questions are the inputs to the model

• FOR ALL SOFTWARE —

Mainframe, mini, micro, business, scientific, real time, interactive

• ACCURATE —

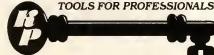
Normally within 20%, often closer

• FAST —

Permits "what-if" investigations

PC-DOS/MS-DOS, 128K RAM. Not copy protected. \$385 direct. Demo disk, \$15. 30-day money-back guarantee.

KEY PRODUCTS



1147 East Broadway, Suite 41, Glendale, California 91205 (818) 957-8843

CIRCLE NO. 132 ON READER SERVICE CARD

SHELF CONSCIOUS?

Now you can organize your copies of
PC TECH JOURNAL

Now your magazines can be a handsome addition to your decor, well organized, and easy to find, thanks to these durable library-quality cases or binders. They're made of luxury-look leatherette over high-quality binder board. And both styles are custom-designed for this or any other magazine you save, with size, color and imprint selected by the publisher. FREE transfer foil included for marking dates and volumes.



Magazine binders

holds your issues on individual snap-in rods, combining them into one volume. \$7.95 each; 3 for \$22.50; 6 for \$42.95. Mixed titles OK for quantity prices.



Open-back cases

store your issues for individual reference. \$6.95 each; 3 for \$19.75; 6 for \$37.50. Mixed titles OK for quantity prices.



OR CALL
1-212-503-5319

PC Tech Journal

P.O. Box 5120, Philadelphia, PA 19141

Please send: Cases Binders

TITLE

QUANTITY

PC Tech Journal

Other: _____

PAYMENT ENCLOSED \$_____ * Add \$1.00 per order for postage and handling. Outside USA add \$2.50 per unit ordered; send US funds only.

CHARGE (Minimum \$10):
 American Express MasterCard
 Visa

Card No. _____ Exp. Date _____

Signature _____

Print Name _____

Address _____

City _____

State/Zip _____

*Residents of PA add 6% sales tax.



New Advanced Symbolic Debugger Handles Complex Overlaid Programs.

Phoenix's new Pfix™86 Plus for MS-DOS®/PC DOS environments features configurable menus and keys, tracebacks, EGA support, and the ability to stop, save, and restore a debugging session at any time.

You can debug without a listing, since you can see and enter symbolic names or absolute addresses in breakpoints, data displays, expressions, or with the in-line assembler.

Display source files, disassembled object, data area, stack, breakpoint settings, CPU and coprocessor registers, simultaneously. Set breakpoints in the source file window. Synchronize the source display with the disassembled object. Add symbols incrementally during the debug session. And write the disassembly to disk.

Pfix 86 Plus supports 80xx and 80xxx CPUs and floating point processors, EGA boards, user-assignable string and numeric variables, up to 100-step tracebacks, and logs to disk or printer.

\$395 complete.

Send for your Pfix 86 Plus information kit today. Call or write:

Phoenix Computer Products Corporation
320 Norwood Park South
Norwood, MA 02062
(800) 344-7200. In Massachusetts (617) 762-5030

Programmers' Pfantasies™ by



Phoenix

CIRCLE NO. 205 ON READER SERVICE CARD
Pfix86 Plus is a trademark of Phoenix Software Associates, Ltd.
MS-DOS is a registered trademark of Microsoft Corporation.

BetterBASIC, Version 2.0

Runs Existing BASIC Programs

"I write a lot of complicated mathematical models for air pollution control.

I have used FORTRAN for its speed, and BASIC for its text handling and graphics, but now I use BetterBASIC for all three. Most of the programs require dozens of different parameters, and BetterBASIC's modular structure allows me to have common routines resident while designing the input forms.

"I have recommended BetterBASIC to my coworkers, and I recommend it to you."

Phil A. Lawless, Ph.D. • Research Triangle Park, NC

ACCESS FULL MEMORY—

BetterBASIC accesses the full memory of the computer enabling you to overcome Microsoft's 64K barrier.

INTERACTIVE

COMPILER—BetterBASIC compiles to an intermediate code giving you five to six times the speed of traditional BASICs. There is immediate feedback on line entry.

COMPATIBLE—Version 2.0 of BetterBASIC is GW-BASIC, PC-BASICA compatible when running on IBM

PCs. BetterBASIC is easy to learn because the syntax is the same.

STRUCTURE—Create well-organized programs using procedures and functions that are easily identified and understood.

NOT COPY PROTECTED—Install BetterBASIC on your hard disk. BetterBASIC is licensed to the programmer, so you can compute at work and at home using the same copy of BetterBASIC.

USER DEFINED KEYWORDS—The BetterBASIC language can be extended by adding your own procedures and functions to the language as keywords.

RUNTIME SYSTEM—Creates stand-alone EXE. files. Developers can distribute their programs written in BetterBASIC without royalties.



SAMPLE DISK—Contains a tutorial, a demo, and allows you to use an abbreviated form of BetterBASIC. It also contains a 60 page on-line mini manual.

AND MORE—Such as DOS and BIOS ROM calls, Chaining, Overlays, Local and Global Variables, Recursion—Graphics and Windows—You can define up to five windows.

Optional 8087/80287 Math Chip Support.

LIBRARIES—Write reusable code.

TECHNICAL SUPPORT—

Available to all registered users.

BetterBASIC Runs on IBM PC, XT, AT and all IBM-compatibles. Ask your local dealer for BetterBASIC or call **1-800-225-5800**. In Canada call 416-469-5244. Also available for the Tandy 1000, 1200 and 3000 at Tandy/Radio Shack stores.

PRICES:

Better BASIC	\$199
8087/80287 Math Module	\$99
Runtime System	\$250
Sample Disk with Tutorial	\$10

Better
BASIC.

Because It's The Best.

CIRCLE NO. 196 ON READER SERVICE CARD

Summit Software Technology, Inc.TM

106 Access Road, Norwood, MA 02062

MasterCard, Visa, Checks, Money Order, C.O.D. accepted and P.O. on approval.

BetterBASIC is a registered trademark of Summit Software Technology Inc.

IBM PC, XT, AT, are registered trademarks of International Business Machines Corp. Tandy is a registered trademark of Tandy Corp.
(If you're using BetterBASIC and would like to be featured in one of our ads, please write to the Director of Advertising at Summit.)

PROGRAMMING PRACTICES

```

        push    ds          ; Save the Turbo data segment.
        call    reloc1      ; Set BX to relocation
                ; factor: true offset ...
        reloc1: pop     bx          ; of reloc1 minus local offset.

        les     di,[bp].param_str ; Get offset:segment
                ; of parameter string.

        mov     ax,es
        mov     cs:lcb_ps_s[bx],ax ; Save parameter
                ; string segment ...

        mov     cs:lcp_ps_o[bx],di ; ... and offset in LCB.
        mov     ax,ss
        mov     cs:ss_save[bx],ax ; Save SS and SP registers
        mov     ax,sp
        mov     cs:sp_save[bx],ax

        push    cs          ; Set up ES:BX as pointer
                ; to the LCB ...

        pop     es
        add     bx,offset lcb_envir
        lds    dx,[bp].prog_name ; and DS:DX as pointer
                ; to the ASCIIIZ ...

        inc     dx          ; ... program name.
        mov     ax,4B00h      ; DOS EXEC function: al=0, ah=4Bh
        int     21h         ; Let her rip.

        sti          ; Disable interrupts while stack messed up
        jc      run_error   ; Successful execution?
        xor     al,al
        ah,ah
        run_error: xor
        call    reloc2      ; Recalculate relocation factor ...
        reloc2: pop     bx
        sub     bx,offset reloc2
        mov     dx,cs:ss_save[bx] ; ... and restore the stack.
        mov     ss,dx
        mov     dx,cs:sp_save[bx]
        mov     sp,dx
        cli          ; Interrupts back on ... all done!

        pop     ds
        pop     bp
        ret     10          ; Pop arguments & "function result"
dos4BH
code
endp
ends
end

```

LISTING 4: DOSCOM.PAS

```

program doscom; { EXECUTE DOS COMMANDS }

{$I spmllib.pas} { INCLUDE SUB-PROCESSES & MEMORY MANAGEMENT }

var
  parameter_string,program_name:asciiz;
  memory_segment,pp_to_release :integer;
begin
  pp_to_release:=$6A5; { PLENTY FOR DOS 3.1 }
  if dos48H(pp_to_release,memory_segment)=0 then
    begin { SEE IF ENOUGH MEMORY FREE }
    if dos_error_check(dos49H(memory_segment)) then
      exit;
    end
  else { IF NOT, THEN REDUCE THE SIZE OF THE CURRENT ALLOCATION }
    if dos_error_check(dos4AH(pp_to_release)) then
      exit;
  if get_comspec(program_name) then
    exit; { TERMINATE IF CANT GET COMSPEC NAME }
  while true do
    begin
      writeln;write('Enter DOS Command: ');
      readln(parameter_string);
      { BUILD THE PARAMETER STRING FOR COMMAND.COM }
      if (parameter_string='bye') or (parameter_string='BYE') then
        exit;
      parameter_string:='/c '+parameter_string;
      parameter_string[length(parameter_string)+1]:=#13;
      if dos_error_check(dos8BH(program_name,parameter_string)) then
        writeln('Command Cancelled.');
      end;
    end.

```

FLOPS

(A FUZZY LOGIC PRODUCTION SYSTEM) For Artificial Intelligence Expert System Development

- IBM PC/XT/AT and Compatibles
- Employs Fuzzy Systems Theory throughout
- Uses multi-valued fuzzy logic and fuzzy sets
- Rule-based system with seven data types
- Emulates parallel computers
- Links to other languages
- Inductive and deductive reasoning
- Tutorial manual and 20 sample programs
- Successfully applied to medical image pattern recognition
- VAX and IBM mainframe versions late 1986
- Free update to next release 1.3 with purchase
- Cost of current release, FLOPS 1.2—\$195

For information, or to place order, call or write:

Dr. William Siler (205) 226-6697

Kemp-Carraway Heart Institute

1600 North 26th Street
Birmingham, AL 35234



CIRCLE NO. 178 ON READER SERVICE CARD

1 MILLION BYTE DISK STORAGE FOR \$50

- MCFORMAT software adds 15% to 50% to hard disk capacity.
- Gives full control over disk format options including standard DOS configuration
- Requires no special training or repeated operations
- Occupies a small amount of RAM alongside DOS
- Fully DOS compatible
- Requires IBM PC (or 100% compatible) with monitor, 128K RAM, and DOS 3.0 or 3.1

To Microcomputer Concepts, Inc.
phone (206) 236-2300 (800) 722-8088
9715 SE 43rd Street, Mercer Island, Washington 98040

YES! I want my hard disk to hold a million bytes more

Please send me _____ copies of MCFORMAT at \$50.00 each

My check drawn on a U.S. bank is enclosed

VISA MASTERCARD _____ Expires _____

I understand I may request a full refund within 30 days if not satisfied

Please ship to

Name _____

Street _____

City _____ State _____ ZIP _____

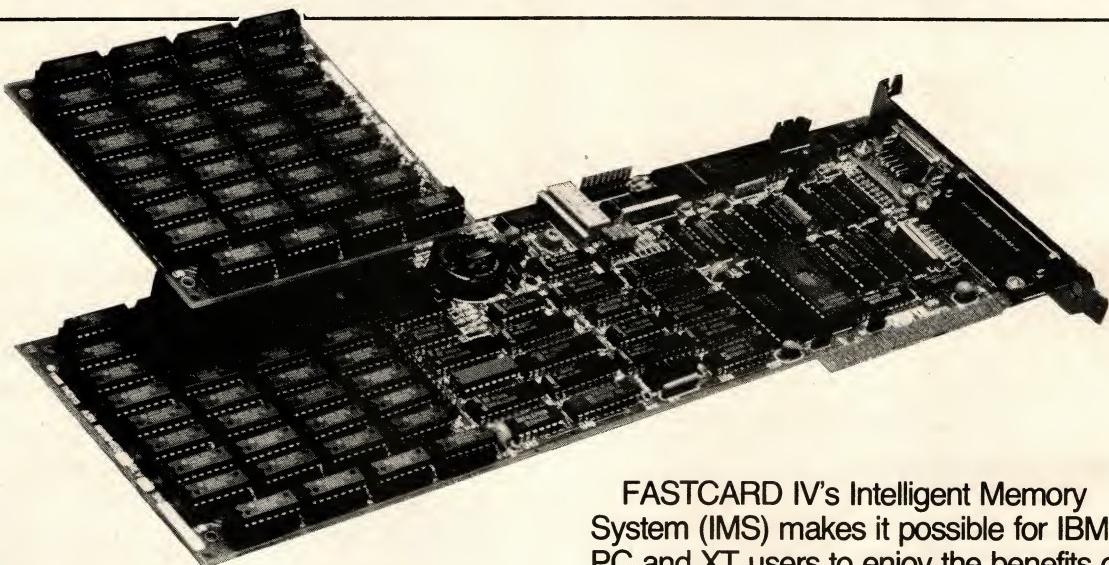
Phone _____ Signed _____

(Washington state residents please add \$4.05 sales tax)

CIRCLE NO. 184 ON READER SERVICE CARD

FASTCARD IV

TWO MEGABYTES FOR YOUR PC—AND MORE!



The power of the Lotus® Expanded Memory Specification is now available in an intelligent, multifunction expansion board—THESYS' FASTCARD IV™.

FASTCARD IV's Intelligent Memory System (IMS) makes it possible for IBM® PC and XT users to enjoy the benefits of up to two megabytes of expanded memory with *all* the software in their libraries—not just programs written especially for expanded memory.

THESYS' IMS features include:

- **Disk Enhancement**—Frequently accessed disk information is stored in system RAM or expanded memory where it may be rapidly retrieved.
- **Printer Enhancement**—IMS allocates memory to serve as a holding area for information waiting to be printed.
- **Automatic Memory Allocation**—IMS monitors the computer's operations and allocates the system and expanded memory as needed for disk enhancement, printer enhancement, or other applications.

In addition, FASTCARD IV offers Data Security features vital to PC users:

- **Custom Password Security** enables the user to define a password that must be entered before the computer will boot.
- **Built-in Diagnostics and Auto Fault Tolerance** identify faulty memory and bypass it until it can be replaced.

FASTCARD IV is Multifunction, featuring:

- **Serial and Parallel Ports and Game Port Interface**
- **Battery-Powered Clock/Calender**
- **Easy-to-use Installation Software.**



For ordering information, contact:
THESYS Memory Products Corporation
7345 East Acoma Drive
Scottsdale, AZ 85260
(800)-327-8345
(602)-991-7356

Reviews and Updates



TURBOREF
Gracon Services



ULTRALOCK
Business Simulations



DEBUGGING DUO
Major Software



WINDOWDOS
Software of the Future

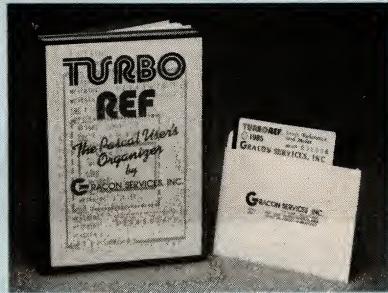


**UPDATE: MICROSOFT
MOUSE**
Microsoft

TURBOREF

Gracon Services
4632 Okemos Road, Okemos,
MI 48864
517/349-4900

PRICE: \$49



CIRCLE 352 ON READER SERVICE CARD

Gracon Services bills TurboRef as "The Pascal User's Organizer." It essentially performs two tasks: printing source code and cross-referencing variables. It also can process multiple source files. A user's manual and full Turbo Pascal source code are included.

TurboRef has a mania for options. The user controls formatting details as well as options such as the case sensitivity of the cross referencer. TurboRef can analyze code for other Pascal compilers. Options are normally set with key words in an option file, but TurboRef can be made to prompt for option settings at runtime or even read them from DOS environment strings. The name of the option file can be entered on the command line when TurboRef is executed. The program's myriad options and flexibility in reading them are its most powerful aspects. What it actually accomplishes is less impressive.

The source linter is not capable of reformatting Pascal code. The main purpose of the listing is to number every line. Line numbers are important because the cross referencer's output is

merely a list of identifiers and the line numbers on which they occur.

TurboRef's manual lists six major capabilities of the linter: drawing boxes around BEGIN-END blocks, highlighting reserved words, highlighting comments, underlining procedure declarations, listing the current procedure on every line, and listing the source file name on every line. Box drawing is the most aesthetically pleasing trick, although it does not necessarily improve programmer productivity. TurboRef's other features are more clearly useless.

The X-REF table does not list the procedure name of the reference and does not separate global and local variables. For example, if the variable *i* is declared locally in three procedures, all the line numbers where *i* occurs are listed together. No indication of dependency or effects of procedures is given.

TurboRef's output is designed for the printer, not the screen. It supports only four printers (the IBM Matrix, IBM Graphics, Epson FX+, and TI 850/855) and provides no convenient way for users to adapt the program for other printers. On the Brother printer used in this review, the results were slightly to thoroughly garbled. The Epson format is acceptable for screen viewing, but is far from perfect.

Numerous other features have quirks: the manual states that the optimal page width is 132 columns, but later says results are "unpredictable" if the form width is not 8.5 inches. Instead of putting the option file name on the TurboRef command line, the user may assign it to a DOS environment string. The manual says the string is XREFOPT, but this does not work. The correct string is TURBOREFOPT.

The cross-reference table tries to put *v*, *c*, or *t* next to a line number if the reference occurred in the VAR, CONST, or TYPE sections of a procedure. However, the proper letters are occasionally missing.

Box drawing is confused by any line, such as a label, that extends to the left of a block. Comments do not affect the placement of boxes, but they do interrupt box lines.

TurboRef handles include files curiously. It places them in the program listing, but does not reset their line numbers. The X-REF table restarts the line count at the beginning of every include file. Thus, X-REF line numbers cannot be related easily to listings.

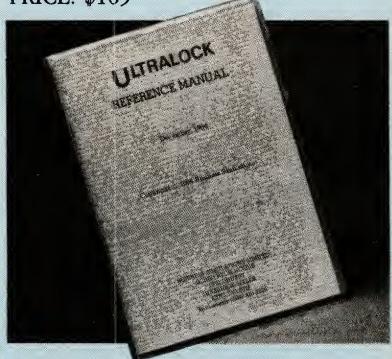
TurboRef processes two to six source lines per second, depending on program size. A 1,000-line program requires about three minutes to complete. The documentation is brief, but not inappropriately so—the program does not do very much.

—CHARLES BRADFORD

ULTRALOCK

Business Simulations, Ltd.
Scriverton House, Speldhurst, Turnbridge Wells, Kent, England TN3 0TU
089286/3105

PRICE: \$109



CIRCLE 351 ON READER SERVICE CARD

Ultralock is a RAM-resident encryption program that operates transparently so only encrypted files are allowed on disk. When a file is loaded into a program it is put into unencrypted form; when saved to disk it is

PRODUCT WATCH

encrypted. Ultralock intercepts each DOS function call for disk reading or writing and encrypts or decrypts as needed. Separate encryption keys can be specified at the beginning of a session for each file or group of files, or this information can be supplied by a key list file for which an encryption key is necessary. Not all files in a directory need be protected.

Once Ultralock is loaded the user can forget about it—no need to recall whether the most recent version of a

file has been properly encrypted. The programs can be copied, but the master disk must be in drive A: or B: for the initial load. The time required for reading and writing increases by 20 percent due to the decryption and encryption. Ultralock requires at least DOS 2.0 and seems compatible with a wide variety of other RAM-resident programs.

Despite its good user interface and clear documentation, Ultralock has some deficiencies. First, the encryption algorithm is proprietary so the user has

little idea of how secure his files really are. Second, although disk files are always encrypted, main memory is not purged when exiting a program. Someone using DEBUG could scavenge main memory and retrieve the sensitive file.

The program's inability to distinguish between ciphertext and plaintext can lead to the following scenario. A key is specified for a file in a particular directory. Inside the editor the user writes out the current file to a different disk or directory. Unless protection on the different disk or directory was previously specified, this file will be written in cleartext. A file backed up to a different disk will be in cleartext.

Ultralock currently does not work with DOS 3.1. Business Simulations, Ltd. said that it will update the program when the European market increases its use of networking. The company has no plans to have customer support available directly from the United States.

Ultralock provides advantages for an environment in which many users share the same hard disk for sensitive data. If transparency is an important factor, Ultralock has no competitor.

—VICTOR MANSFIELD

Get a Grip on Assembly Language. The Visible Computer: 8088

Assembly language programming isn't easy, but you don't have to be a genius to learn it. Let your PC teach it to you.

The Visible Computer: 8088 is a comprehensive system of book and software for mastering the elusive skills of assembly language.

It's an animated simulation of the 8088 microprocessor that lets you see with your own eyes how the 8088 works. You'll be using it as a debugging tool for years to come.

It's a tutorial. The 350 page manual is more than instructions on

running the simulator—a lot of people think it's the best book on assembly language ever written.

Its 45 demonstration programs you'll work through with the 8088 simulator, from simple register loads to advanced programs that manipulate interrupts and perform file I/O.

PC Tech Journal
"Program of the Month"
"(The Visible Computer) is at once useful and educational, offering an interactive debugger and a self-paced course in 8088 architecture and assembly language... A considerable value."

NEW! Copy protected version saves money! The Visible Computer: 8088 for IBM PC/XT/AT and true compatibles. \$49.95 (copy protected) \$79.95 (unprotected) If your dealer doesn't have it, order direct: Software Masters, 2714 Finfeather, Bryan, TX 77801 (409) 822-9490. Please include \$3.00 shipping. Bank cards accepted.

**Software
Masters™**



TVC lets you see into an 8088 as it executes programs

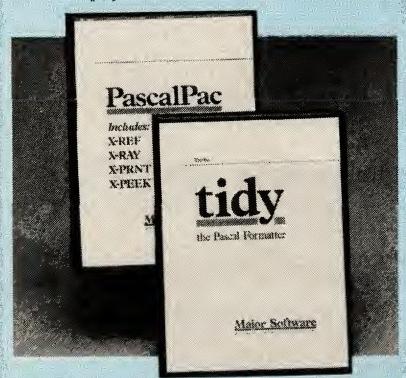
CIRCLE NO. 168 ON READER SERVICE CARD

DEBUGGING DUO

Major Software

66 Sylvan Way, Los Altos, CA 94022
415/941-1924

PRICE: \$79



CIRCLE 353 ON READER SERVICE CARD

Major Software's Debugging Duo is uneven in its quality. The company has been selling Tidy, a Pascal formatter, for more than a year, but has made few changes since the version reviewed in "The Well-Formatted Pascal" (Steven Armbrust and Ted Forgeron, *PC Tech Journal*, October 1984, p. 22).

Tidy is still fast, dependable, and useful. It takes any error-free Turbo Pascal source file and produces properly

The Conference That Takes A Hard Look At The Business Side Of Software.

The Software Business Conference April 2 & 3, Los Angeles, California

This prestigious conference, held in conjunction with COMDEX/Winter, will provide a forum for developers, publishers and resellers of software to discuss common interests, challenges, and solutions.

The Software Business Conference will also create an environment in which to discuss and establish new business relationships.

By bringing the three main bodies of the software industry together at one major conference, the Software Business Conference proposes to raise the visibility of software issues worldwide, and to assist in bringing high quality products to the market.

To ensure that the Conference meets its goals and is relevant to your interests, these and other noted distinguished industry leaders are helping to shape this major event: Joel Berez, President, Infocom, Inc.; Daniel Bricklin, President, Software Garden, Inc.; Seymour Rubenstein, President, MicroPro International Corp.; Gary Kildall, President, ActiVenture Corp.

Software Business Conference Schedule

Plenary Sessions

A Marriage of Objectives; Keeping Pace with a Changing PC Environment.

Marketing Sessions

What's Selling? The Software Marketplace; Who's Buying? Applications and Users.

General Sessions

Managing the Successful Software Company; Software Development Technical Strategies; Software Development Management Strategies; Exploiting the New Software Product; Supporting the New Software Product; The Great Code Rush: Prospecting for New Packages

Workshops in Software Entrepreneurship

Workshop in Creative Financing; Workshop in Creative Marketing and Selling

To be part of this exciting business and learning experience, send today for complete registration information.

Yes, I Want To Take A Hard Look At Software, Too.
Send Me Detailed Information.

Name _____

Address _____

City/State/Zip _____

Phone _____

I'm a Developer Publisher Reseller Other

Mail to: Software Business Conference
300 First Avenue
Needham, MA 02194

Presented by



The world's leading producer of computer and communications conferences and expositions.

300 First Avenue, Needham, MA 02194

CIRCLE NO. 135 ON READER SERVICE CARD

©Copyright 1986

PRODUCT WATCH

indented code with well-placed comments and capitalized reserved words. Version 4.9 differs from earlier versions in that it provides runtime options for generating output with numbered lines and/or 132 columns.

The second and newer partner in the Debugging Duo is PascalPac. Major Software says PascalPac is intended to be used with Tidy, but the products do not seem to depend on each other or communicate with each other in any way. Their manuals are similarly bound in thin cardboard-backed pamphlets; Tidy's manual shows signs of having been proofread, while PascalPac's manual is full of garbled sentences.

PascalPac actually consists of four utilities. X-REF is an unusually lame cross referencer. It reads a source file and lists in alphabetic order all the identifiers the file contains. Next to each identifier, X-REF lists all line numbers on which that identifier appears.

And that's it. X-REF does not handle include files and does not provide any information about interprocedural dependencies. It makes no attempt to distinguish between global and local variables of the same name, or between lines on which a variable's value might change and those on which it is merely

referenced. X-REF provides only an index, by line numbers, of all the identifiers in one source file.

X-RAY uses the output of X-REF to find identifiers and display them in the context of surrounding lines. It splits the screen horizontally and uses the top half to display the source file and the bottom half to display the output of X-REF. X-RAY is similar to a read-only editor that uses X-REF's output to speed up its search function.

X-PRNT is an unremarkable program for printing text files. It can paginate a listing, number lines, print time- and date-stamped headings, or halt while the user inserts paper in a printer with no tractor-feed mechanism.

X-PEEK is a version of X-RAY that does not use the output of X-REF. It loads a text file and lets the user page or scroll through it forward and backward. X-PEEK, like X-RAY, is command-oriented. The cursor remains on a command line at the bottom of the screen at all times. To move the display one line up the user types UP (or presses the up arrow) and presses Enter.

X-PEEK could be useful if it were smaller and a bit more powerful. Most programmers could use a small read-only editor that loads quickly, handles

big files, provides reasonable string-search and spot-marking facilities, and allows rapid movement through the file.

X-PEEK is not it. X-PEEK.EXE is 46,040 bytes long; several real editors, such as IBM's Personal Editor and QuickSoft's PC-Write (a "shareware" program), are about the same size or smaller. X-PEEK will not load a file larger than 32KB. It also does not use the BIOS scrolling routines to move the screen display. It writes screens quickly, but to scroll up or down a single line, it rewrites the entire screen and causes an annoying flash. It provides no functions beyond simple page- or line-oriented movement through a file.

Although Major Software does not consider X-PEEK to be the lead utility in PascalPac, it might eventually be useful. The rest of PascalPac offers the user little more than an editor with a fast string-search function.

Tidy, on the other hand, is quite nice. It makes Pascal easier to read and understand, and thus serves more than a cosmetic function. Even if its function were only cosmetic, it would serve a useful purpose. Programmers have enough to do without worrying about stylistic niceties.

—COLE BRECHEEN

nine track tape users Micro to Mainframe Connection

The Model TC-50 1/2-inch tape subsystem provides a standard medium for transmission of mainframe data base information to PC users, while maintaining mainframe isolation and data integrity. Use ODI subsystems to import data to data base programs like dBase III.

The TC-50 subsystem also provides fast back-up capability as well as a device driver and interface software for popular compilers.

The TC-50 subsystem includes tape drive controller, cables and documentation. All ODI products carry a 30 day unconditional money-back guarantee, and are warranted for one year, parts and labor.

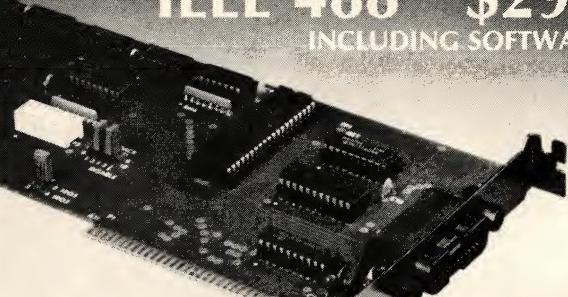


Overland Data, Inc.
5644 Kearny Mesa Road
San Diego, CA 92111
Tel. (619) 571-5555
Telex 754923 OVERLAND

Also Available —
XENIX tape
subsystems
for the
IBM AT

CIRCLE NO. 185 ON READER SERVICE CARD

IEEE 488 \$299 INCLUDING SOFTWARE



Real Time Devices' GP100 is a full capability GPIB (IEEE 488) interface for the IBM® PC that includes high-speed software for the single quantity price of \$299.

- Over 40 high and low level GPIB commands
- Fast assembly language extensions to BASIC
- DMA and interrupt capability
- Comprehensive tutorial/instruction manual
- No hidden software, cabling, or documentation charges
- Supports up to 15 devices
- FORTRAN, PASCAL, and FORTH extensions available

Even if you're not familiar with GPIB interfacing, the GP100 will have you controlling this powerful bus in no time at all, allowing you to focus on your application requirements.

So if you've been intimidated by the complexity or cost of other GPIB implementations for the IBM PC call on us to help — you'll be pleasantly surprised.

Real Time Devices, Inc.



1930 PARK FOREST AVENUE
P.O. BOX 906
STATE COLLEGE, PA 16804
(814) 234-8087

CIRCLE NO. 165 ON READER SERVICE CARD

OASYS
Hardware Breakthrough

EVER WISH YOUR PC COULD OUT-PERFORM A VAX? A SUN?

- Ever wish your PC ran faster? Had 10 to 20 times more throughput?
- Ever wish your PC had the same kind of high quality, professional software development tools (compilers, assemblers, simulators) you'd normally find in VAX, super-mini or super-micro Unix workstations?
- Ever wish you could port a scientific or commercial application to a PC without having to recode or restructure your software just to accommodate Intel's architecture?
- Ever wish you had a choice of MS-DOS or Unix V on the same system without having to commit your entire system to one or the other? Ever wish MS-DOS was a virtual demand paged operating system?...

OASYS MS-DOS Co-Processor *... your wish has come true!*

The DS-32 PC Co-Processor Board is a self-contained 32-bit computer system — it operates at super-micro speeds (**10MHz** and no wait states), comes with its own large memory space, full floating point support and highly optimized software tools (both native and cross). It's fully compatible with your standard PC MS-DOS system — no file conversions or re-training is needed. Installation takes just a few minutes — plug it in and go to work.

DS-32 Features:

- Uses National's 32032 processor running at 10MHz. (a 32-bit processor running at super-micro speed; out-performs a mid-size VAX and most 68000 workstations. Your PC will run 10 to 20 times faster)
- Uses its own on-board memory: 1 or 2MB versions. 4 to 6MB expansion boards coming.
- Choice of Operating Systems:
 - MS-DOS Standard: You don't have to learn another OS or do any conversion.
 - VIRTUAL MS-DOS Option: the first demand paging version that supports files as big as your disk.
 - Unix System V Option.
- Fits any IBM PC, XT, AT or look-alike. (Compaq, Wyse, etc.). Uses only one slot.
- Provides its own on-board floating point support.
- Based on Definicon Systems technology.
- Supports dozens of NATIVE high level, optimizing languages; C, Pascal, Fortran. Comes with Assembler, Linker, Loader and Debugger. Exciting new additions: Ada, APL, Basic, and AI tools (LISP, Prolog).
- Supports full complement of CROSS development tools to most 32-, 16-, and 8-bit target systems. Example: 68000/10/20 C, Pascal and Fortran Cross Compilers, Assemblers, Simulators, Debuggers, Profilers. 8086/186/286 C, Pascal and Fortran Compilers.

Possible Applications:

- Run large, time consuming CPU-bound applications on a PC:
 - scientific, commercial, avionic, biomedical
 - petrochemical, seismic
 - microprocessor simulations
 - CAD/CAM and graphic designs
 - numerical applications
 - data reductions, matrix operations
 - recursive type programs (e.g., AI tools)
 - ...the possibilities are *limitless*
- Provide a low cost means of turning your PC into a high-powered software development workstation.
- Minimize porting time, effort, and support problems; eliminates having to contend with Intel 8086/88/186/286 architectural differences (e.g., 64KB addressing limits).

OASYS offers a "One-Stop Shopping" service for software developers. We support, maintain, develop, enhance, and port over 100 high quality, professional software and hardware tools running on numerous hosts (VAX, PC's, Apollo, Sun, Pyramid, etc.) and/or targeting popular 32-, 16-, and 8-bit micros and operating systems.

A DIVISION OF XEL

Oasys

60 Aberdeen Avenue, Cambridge, MA 02138 (617) 491-4180

We Specialize In:

Cross/Native Compilers C, Pascal, Fortran, Cobol, Basic, APL, Prolog, Lisp, Ada — Assemblers/Linkers — Symbolic Debuggers — Simulators — Interpreters — Translators Converters — Profilers — QA Tools — Design Tools — Comm. Tools, OS Kernels — Editors — Spreadsheets — Data Bases — VAX & PC, Attached Processors and more

We Support:

680xx, 80x86, 320xx, 68xx, 80xx, dozens more

Trademarks are acknowledged to: Digital Equipment Corp.; AT&T Bell Labs; Microsoft Corp.; National Semiconductor Corp.; International Business Machines Corp.; US DOD Joint Development Office; Intel Corp.; Apollo Computer Inc.; Pyramid Technology Corp.

CIRCLE NO. 150 ON READER SERVICE CARD

PRODUCT WATCH

WINDOWDOS

Software of the Future, Inc.
P.O. Box 531650, Grand Prairie,
TX 75053
800/433-5355; in Texas, call
214/264-2626

PRICE: \$49.95



CIRCLE 354 ON READER SERVICE CARD

Navigating through the subdirectories of a packed hard disk is not an easy task. A user often needs to browse through the current directory while using an application, glance at the contents of a file, or start searching for a group of files with little to go on.

WindowDOS is one small, quick, and usable contender among memory-resident DOS extensions that are used to tame this hard-disk complexity. It is a full-screen DOS interface that makes good use of foreground and background colors, the function keys, and the numerics pad. Its memory-resident form provides expanded DOS commands with hot-key convenience; a user typing away in a word processor can simply press the Ctrl-Ins combination to examine directories, delete files, and change the default directory, then return to the application by pressing the Esc key. A prompt line option tells WindowDOS whether to stay resident after Esc or release its memory to DOS. WindowDOS can run on a monochrome, color, enhanced color, or professional graphics monitor and can work with hard, floppy, and RAM disks.

WindowDOS screens are generally clean and readable; they show file names and provide more detail only if it is requested by the user. The basic screen is a 17-by-5 table of the files and subdirectories in the current directory. Files are selected by moving the cursor to the file name using the cursor-control keys, a great improvement over typing file names. WindowDOS has no mouse interface, but it is hardly needed with all eight cursor-control keys available. If the entry is a file, its attributes and size are displayed on the upper left

of the screen. A single keystroke lists the file in hex or ASCII format. If the entry is a directory, pressing the Enter key updates the table to the new directory. A prompt line along the bottom of the screen lists standard DOS functions; the user can access more specialized functions through function keys and pop-up menus.

Used in combination, these functions let the user flip through directories with ease, examining, reorganizing, copying, or deleting along the way.

This housekeeping can be done in several different styles. Pop-up menus provide a search command equivalent to WHERE.COM (see "A Good Find," Mark S. Ackerman, *PC Tech Journal*, October 1985, p. 85) and a subdirectory diagram equivalent to DOS's TREE. But a user would turn to these exhaustive disk-bound techniques only as a last resort; WindowDOS encourages a more interactive method. Cursor key selections from directory tables simplify the task of paging through directories by mov-

Leap MS-DOS Software With A Single File!!

It's



More powerful than Prokey™ or Superkey™!
Stops integration nightmares with its bare bits!

SuperBatch™ is a powerful utility program that creates batch files that drive almost any program (LOTUS 1-2-3™, Wordstar™, etc.). It also continues execution from program to program. Common uses include:

- Integration of individual programs to form a system.
- Creation of self running demo systems.
- Inserting repetitive procedures into a SuperBatch™ file for simple execution.

Please send [] Info [] SuperBatch

Name _____

Addr _____

Addr _____

Addr _____

City _____

State _____ Zip _____ Tele _____

Please mail or call 313-645-5280 to place your order.

\$79.95 with a 30 day Money Back Guarantee

Canadian orders add \$10.00 for shipping.

_____ copies x 79.95 _____
MI res. add 3.20 sales tax per _____
Total _____

Merrill Street Software
Division of BCC Inc.
251 Merrill Street
Birmingham, MI 48011

Payment [] Visa [] MC [] Chk [] PO [] Bank Draft [] COD

Name Cr Card _____
Cr Card No. _____ Card Exp. _____

Prokey™ is a registered trademark of RoseSoft, Inc. Superkey™ is a registered trademark of Borland International. Lotus 1-2-3™ is a registered trademark of Lotus Development Corp. Wordstar™ is a registered trademark of Micropro International. SuperBatch™ is a registered trademark of BCC, Inc. SuperBatch™ requires MS-DOS 2.0 or greater.

CIRCLE NO. 138 ON READER SERVICE CARD

PRODUCT WATCH

ing up or down the directory tree. A default file spec option further focuses the search; when set to `t.*.`, for example, it displays only those file and directory names that start with the letter `t`. Another nice feature is use of the Tab key, which cancels a command line the way Esc does in DOS.

WindowDOS augments DOS's ability to process groups of files with a single command. When wild-card specifiers are inconvenient, the user can select and mark files on a screen for collective copying or deleting. WindowDOS's PURGE command allows another style of deleting; it displays specified files one by one and prompts for deletion. The SORT command organizes directories by size, creation date, name, or extension.

Other enhancements include the RENAME command, which can be used to move files from one directory to another without actually copying them. The directory entries are changed but the files remain in their old physical location. Other commands are mapped onto the function keys and accessed with pop-up menus.

Although some WindowDOS commands are powerful, they are inconvenient to use. In updating a directory, for example, WindowDOS forces the user to type in the entire path name for the new directory. Users of huge directories will encounter yet another WindowDOS limitation. It can display only three screens of files (255 entries) and ignores the rest.

WindowDOS is a useful product as it stands, but a few patches and enhancements could make the next version much better. It has a command to create a directory, but not to delete a directory; furthermore, it has no provision to rename a directory or volume. WindowDOS would take on some debugging ability if it were able to modify files or display an area of memory. Another useful feature would be an expanded type-ahead buffer.

Overall, WindowDOS is a well-designed and useful product. The manual is short and worth reading. The sparse on-line help is adequate because most screens are self-explanatory. WindowDOS is perfectly usable in non-resident mode but its 40KB resident size should not strain a system's resources. It does not take up much memory for the functions it offers; Borland's SideKick, for example, is 20KB bigger and the DOS enhancer XTREE is more than three times as big.

—DAN BEALE

MICROSOFT MOUSE

Microsoft
10700 Northup Way, Bellevue,
WA 98009
800/426-9400; 206/828-8080

PRICE: Serial, \$195; bus, \$175

UPDATE

CIRCLE 355 ON READER SERVICE CARD

Microsoft's Mouse was not the first generally available mouse for the PC, but with Microsoft's influence, it set the standard for mouse software interface (see "A Tale of Two Mice," Jeff Duntemann, *PC Tech Journal*, April 1984, p. 150). Microsoft has updated the Mouse software several times since its release in November 1983; now the hardware has been redesigned—in time for the long-awaited release of its software destiny, Microsoft Windows.

The most apparent difference is one of ergonomics. The new mouse casing fits the hand much better than did the original mouse. The button actuators now wrap around from the top surface of the mouse toward the front, accommodating several different grips and button-pressing styles.

The second revelation comes in pushing the Mouse around the tabletop. The original Mouse rode on a large satin-finish steel ball in a loose cage and four steel ball bearings in tight races. All that metal generated an annoying clatter when moved rapidly. The new Mouse scoots about smoothly on Teflon slides, its position-sensing ball coated with soft plastic, à la Macintosh.

The original Mouse cable connector did not have lock-down screws to mate with standard D-style connectors and, consequently, came unplugged at the least provocation. The redesigned cables can be locked into their D-connectors with thumb nuts.

Microsoft recognized that the main position-sensor ball in a mechanical mouse gets dirty. The old mouse re-

quired a screwdriver to get at the ball cage for cleaning. The new mouse has a snap-in, snap-out ball retainer.

All these changes are absolutely on-target, and the new Mouse appeared at first glance to be about as good as any mechanical mouse is likely to get; however, one race around the table uncovered an agonizing, crippling flaw: the two actuator buttons, while placed perfectly, do not click. Upon pressing, the new Mouse buttons simply descend and bottom out, with the dullest hint of a click at the very bottom.

Clicking provides positive feedback that a selection has been made. Without a solid, snappy click from the mouse switch, the user must watch the screen to see if the desired selection took place. This erodes confidence in the channel of communication between mouse and machine and distracts from the job at hand. The new Mouse is less pleasant to use because of its buttons, irrespective of all the other excellent improvements in the mechanics.

The motion-sensing mechanism now has a resolution of 200 points per inch (the original Mouse resolved 100 ppi), reducing by half the disk area required to move the pointer through an entire graphics screen.

The Mouse driver software interface has two new function calls. Call 16 hides the Mouse pointer conditionally, if the pointer enters a predefined area. Call 19 (calls 17 and 18 do not exist) defines a threshold speed value (given as mickeys/second) past which the apparent speed of the pointer across the screen doubles. This feature allows the user to move the pointer from one end of the screen to another very quickly.

PC Paintbrush, Z-Soft's paint program that Microsoft bundles with the Mouse, has been greatly improved in terms of speed and features. The updated program can rotate rectangular regions of the screen and generate spline curves. In addition, the screen-print utility, Frieze, supports many more printers and is considerably easier to use than earlier releases.

Release 5.0 of the Microsoft Mouse and supporting software is hair-tearingly schizophrenic. What began as a masterful redesign of an industry classic was ruined by the use of cheap switches on the internal logic board. Microsoft has the power to find better switches if people demand them. Until then, however, take this Mouse for a test drive before buying it.

—JEFF DUNTEMANN



Introducing



Expires Mar. 31, 1986

If the Revolutionary New **Q-DOS** Hard-Disk File Manager
Does Not Do Everything On The Following List,

We Will Give You Your Money Back And Buy You The Hard-Disk File Manager of Your Choice!!

CALL TOLL FREE 800-233-0383 8:00 a.m. to 8:00 p.m. MST, Mon.-Sat.

Here Is Our Promise:

- Q-DOS is by far the quickest, most versatile program available anywhere for managing your hard-disk files.
- Q-DOS will make performing all DOS functions infinitely easier and faster.
- Q-DOS will find most files on your hard disk within three seconds, and any file within eight seconds, regardless of the subdirectory in which it resides.
- Q-DOS will read and sort 200 files from your disk in less than two seconds!
- Q-DOS will teach novice users the concepts of disk organization.
- Q-DOS will help you copy, move, erase, or rename files — without typing file names or directory paths.
- The directory command in Q-DOS instantly displays a dynamic "directory tree" diagram of any disk. When moving or copying files, simply point to the destination directory (even when copying from one disk to another!)
- Q-DOS will show you a list of the files in any subdirectory on any disk, sorted by name, extension, size or date.
- Q-DOS protects important or sensitive files by hiding them or by making them "Read-only."
- Q-DOS has complete documentation on the disk in the form of on-line, context-sensitive help. You just press **F1**.
- Q-DOS is NOT COPY PROTECTED!

And Much More!

This is just a partial list of the powerful features of Q-DOS. You can also view the contents of any file, check the available space on any disk, execute other programs, find hidden files on your disk, compare the contents of two directories at a time, and on and on. **And most amazingly, It costs a fraction of what you might expect.**

Your Zero-Risk Guarantee

We are so confident that you will be amazed and thrilled with Q-DOS, that if you decide that you're not satisfied, we will not only send you your money immediately upon request, but will buy and send to you any hard disk file management program you choose.

Why are we so confident? Because it does everything we claim and more. Look what the professionals are saying about this disk-management tool:

"Q-DOS is the fastest, smoothest, most effective disk-manager program I've encountered to date. It permits me to organize and, manipulate my hard disk in a fraction of the time that would be required otherwise. I've been able to replace the entire group of utility programs with a single copy of Q-DOS. It does everything they did — but faster and better."

Dave Hoagland
Livermore, California

We know you'll love Q-DOS, but, if you don't, send the disk back to us, tell us the name of the hard-disk file manager you want, and we'll buy it for you! On multiple orders, upon request and return of all disk copies, the money you paid will be refunded, but the Buy-The-File-Manager-Of-Your-Choice offer applies only to one disk program per purchaser.

IBM, IBM PC, IBM PC/XT, and IBM PC/AT are registered trademarks of International Business Machines, Inc.

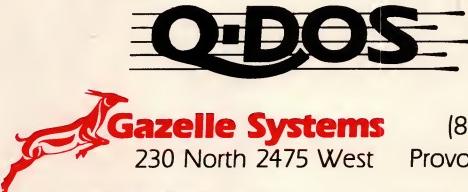
CIRCLE NO. 204 ON READER SERVICE CARD

"I have found Q-DOS to be the most useful of all the hard-disk utilities today. It is much faster and easier to use than other products of its type. I carry a copy with me on all jobs now, and I would not think of making changes to or reorganizing a hard disk without it. The ability of Q-DOS to make or remove directories instantly and copy and/or move data from one directory to another almost instantly is nothing short of amazing. I recommend it to all my customers with hard disks."

Jim Nolan, Manager
ComputerLand of Dublin
Dublin, California

To make this offer even more attractive, if you respond to this charter offer, we will provide FREE no-fault bug insurance, AND will provide free updates as often as they occur for as long as you own the program.

Your Q-DOS program can never become obsolete! This program will sell for \$69.95, but not to you, if you respond to this ad. This one time only the charter-offer price is only **\$39.95!** That's right, only \$39.95! Far faster, far simpler, far more features, and far less money! And it's guaranteed!



(801) 377-1288
230 North 2475 West
Provo, Utah 84601

System Requirements: IBM PC, XT, AT or compatible. Hard disk or two drives recommended. 256K memory, Dos 2.0 or higher.

TOLL FREE 800-233-0383

Expires Mar. 31, 1986

Please rush me _____ Q-DOS disks at your special one-time only introductory price of only \$39.95. That's **\$30.00 OFF** our regular price of \$69.95 (Add \$3 for shipping and handling. UT residents add \$2.30 sales tax per copy.) All orders shipped within one business day.

Circle One: VISA MASTERCARD C.O.D. (U.S. only) CHECK

Card number _____ Exp Date: _____

Total \$ _____ Phone: (_____) _____

Name: _____

Address: _____

City: _____ State: _____ Zip: _____

Foreign orders, add \$10 for shipping and handling. Send to: **GAZELLE SYSTEMS**,
230 N. 2475 W. Provo, UT 84601. (801) 377-1288.

30-DAY MONEY-BACK GUARANTEE — DEALER INQUIRIES INVITED

G

END RUN dBASE III[†]

The dBASE[†] sign-off has never made more sense.

Because Word-Tech software can run your dBASE programs 3 to 10 times faster. Run them on multi-user and networking systems. Eliminate site licenses and runtime fees forever. And save you over \$500 on a single-user, extended version of dBASE III.[†]

Our MS-DOS compilers run your dBASE applications faster and in just 128K of free memory on any MS-DOS computer, not only the IBM PC.

You don't pay any penalties because WordTech compilers use the same language and syntax as dBASE and the same index, memory and data files (up to 10 data files open simultaneously, each with up to 7 indexes).

And WordTech dBASE II[†] and III compilers are just \$750, once. Then you only need a single copy of dBASE for every programmer, not

Good idea.

every user, and can distribute as many copies of your compiled (and protected) programs as you want with no strings attached.

And now you can use dBASE III on multi-user and networked systems. Our multi-user compiler runs your existing dBASE programs under AT&T's UNIX System V and CROMIX. And our networking compiler runs your applications on DOS 3.1

local area networks (LAN's). The compiler will take care of file and record locking for you, or you can take full control using dBASE III networking commands.

We can extend your applications—and your budgets—even further with dBFrameTM for windows, dBChartTM for business graphics, and dB-XLTM, the \$169 interpreter that replaces dBASE III.

And we back everything with free support, one year of maintenance and a money-back guarantee.

For details and the name of your nearest dealer, contact WordTech Systems, Inc., P.O. Box 1747, Orinda, CA 94563. (415) 254-0900. TELEX 503599.

It might be a good idea to call now.



**WORDTECH
SYSTEMS**

*Trademarks of Ashton-Tate, Inc. CROMIX Trademark Cromemco, Inc.
UNIX Trademark AT&T Bell Labs. MS-DOS Trademark Microsoft, Inc.

©1985 WordTech Systems, Inc.

License to Sell

The software license agreement, although widely accepted by users, is not always the clear-cut decision for publishers that it seems to be.

The first Legal Brief ("The IBM Software License," July/August 1983, p.149) examined the IBM license agreement and pointed out provisions that should have caused customers to resist if not rebel. It now has to be conceded that the license agreement technique is by far the most common form of transfer of rights in computer software.

With the benefit of nearly three years' hindsight, license agreements deserve another look, this time with an emphasis on how a publisher might evaluate the pros and cons, vis-a-vis as agreements for the sale of software. To compare apples with apples, assume that the publisher has the choice of either a written license agreement or a written sales agreement.

In general, software license agreements have the following goals:

- They seek to limit warranties.
- They seek to limit the liability of the publisher.
- They seek to apply the law of one particular state to the interpretation and enforcement of the license.
- They seek to control dissemination (and copying) of the software.

Surprisingly, few software license agreements attempt to accomplish what license agreements traditionally do: set a limited term of use and provide for periodic fees for continued use. Given that the publisher is willing to grant perpetual use of his software in return for a one-time fee, is there any advantage to his using the license mechanism rather than a sale?

The first objective (restricting warranties) certainly can be accomplished in the context of a sale. Certain requirements must be met if a manufacturer wishes to claim that his product carries a full warranty, but if he chooses instead to give a limited warranty, he has wide latitude in setting its terms. He can, if he chooses, sell his product "as is," with no warranty. To create a limited warranty, he must comply with cer-

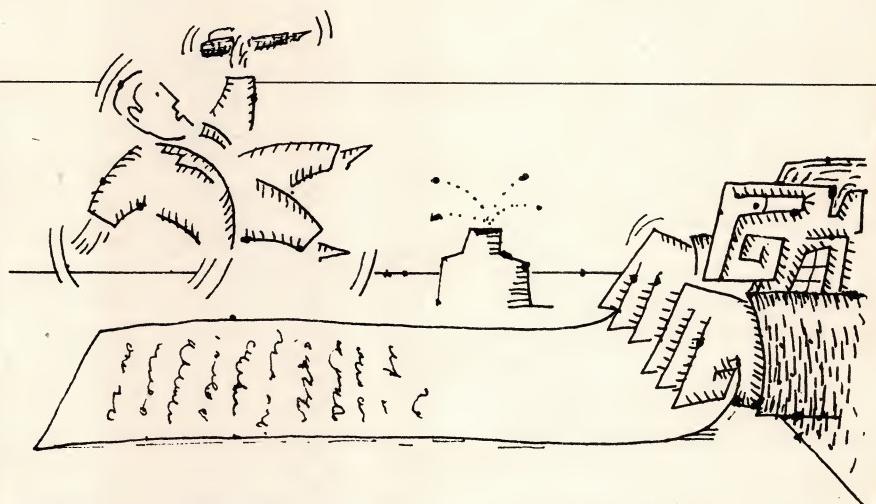


ILLUSTRATION • MACIEK ALBRECHT

tain requirements as to form, but these requirements also apply if the product is licensed rather than sold. No advantage is apparent to a perpetual license agreement over a sale from the viewpoint of limiting warranties.

The second objective of limiting the amount of liability overlaps with the first. It comes into play in the case of a breach of warranty or if the licensor violates the license agreement in some other way (admittedly, an unlikely event). In that case, even though the licensee is entitled to compensation, the amount of the compensation is limited to some specified amount.

Suppose a license agreement warrants that the software will conform to the specifications in the manual, and the manual says that the software will calculate payroll deductions and subtract them from gross pay to arrive at net pay if the specified steps are followed. Further, suppose the license contains a limitation of remedy provision, which provides that in the event of a defect the licensor will replace the software or refund the purchase price (here, say \$100) at licensor's option; all incidental, consequential, and special damages are disclaimed. The software calculates payroll deductions, but it adds them to rather than subtracts them from gross pay. The licensee clearly

wins his breach of warranty claim, but all he gets (if the limitation of remedy provision is enforceable) is \$100, regardless of the loss he has incurred. This, however, is not unique to the licensing approach; a similar provision in a sales contract would face the same issues as to enforceability and, if it survived, would lead to the same result.

While broad similarities exist among the various states' laws, significant differences also are present in statutory provisions and in the development of case law. A Maryland company has a legitimate interest in uniformity of interpretation of its contracts regardless of where the other party to the contract is located. This interest in uniformity can be advanced by providing in the contract that it will be interpreted and enforced according to Maryland law. Generally, a company can select the law of its state of incorporation or a state where it has substantial business contacts. The enforceability of a choice-of-law provision would be more doubtful if the state were chosen because it had favorable provisions in its law.

The final common objective is to limit copying of the software. Federal copyright law prohibits copying (whether a license or a sale is involved) unless it falls within a recognized exception, such as fair use, copying as an essential

LEGAL BRIEF

step in utilization, and archival copying. Some publishers wish to restrict the right to such noninfringing uses as well. They do not want the customer to lend or rent his copy of the software. Under the *first sale doctrine*, the owner of a copy of a copyrighted work could do so: once the copyright holder has made a sale of a copy of the work, the new owner may treat his copy as his property and resell it or make any other use of it not in violation of the copyright law. He cannot make additional copies for sale. The first sale doctrine is perceived to be avoidable by licensing rather than selling the software, because no first sale has taken place.

Doubt still exists as to whether a shrink-wrapped license agreement can defeat the first sale doctrine. Louisiana and Illinois have enacted statutes attempting to support that result, but neither has been through a Constitutional challenge. Although it is doubtful that copyright law offers an advantage to shrink-wrapped license agreements, the license approach offers a better chance of restricting rights granted owners under the copyright law. If the publisher faced no additional risk by licensing rather than selling, this advantage might justify a decision to use the licensing technique.

Section 541 of the Internal Revenue Code provides for special taxation of a *personal holding company*: a company that is a corporation, with more than 50 percent of the value of its outstanding stock owned by no more than five individuals, and 60 percent of its "adjusted ordinary gross income" is "personal holding company income," which includes royalties and rents. Provisions for copyright royalties take them out of the category of personal holding company income. To escape such categorization, certain tests must be met (including the test that royalties from software *not created in whole or in part* by any shareholder constitute at least 50 percent of the corporation's ordinary gross income), and the threshold issue of whether the typical shrink-wrapped license agreement generates "copyright royalties" at all must be considered. On the other hand, arguments could be made that, although characterized as a license fee in the license agreement, the one-time fee provided for in a shrink-wrapped license agreement is really a purchase price, or that a one-time license fee is not a royalty because it does not depend on the degree of use of the licensed software.

Choosing to license software presents the risk that the publisher is re-

ceiving personal holding company income that could be subject to the provisions of Section 541 et seq. If the software is sold, the problem is avoided.

Currently a 50-percent tax is levied on undistributed personal holding company income. The tax can be avoided by distributing the income but (assuming it is distributed to stockholders as a dividend) the stockholders then will be subject to a tax on the dividend. If the company needs to retain the income at the corporate level to finance product development, the choice of the license mechanism may prove costly.

The impact of the tax risk on a company's decision to license or sell can be evaluated only on a case-by-case basis. IBM presumably did so and concluded that it had no risk of being deemed a personal holding company. In that context, even if the potential benefit of opting for licensing is very small, the risk is even smaller so the choice to license is not difficult. For many software companies, the choice is not so clear-cut; the potential tax costs may outweigh the potential copy restriction benefits.

Max Stul Oppenheimer, PC, is a partner in the law firm of Venable, Baetjer & Howard, located in Baltimore, Maryland.

IMT opens SideKick[©]-style windows

for you..

- Written in assembler for super speed!
- Capacity - five independant windows at one time
- Source code available • Non copy protected
- Requires IBM or 100% compatible, floppy 256K
- Easily interfaced to most programming languages

from basic

for Window-Weaver call
or send \$49.95 u.s.
to

IMT Integrated Micro Technology
P.O. Box 698, Stn. J, (403) 293-5972
Calgary, Alberta T2A 4X8

SideKick is a registered Trademark of Borland International
IBM is a registered Trademark of International Business Machines

CIRCLE NO. 159 ON READER SERVICE CARD

SCIENTIFIC CALCULATOR

How Many Times Have You Had To Reach For A Hand Held Calculator While using Your PC?

WELL REACH NO MORE!

Introducing The KSH-1 Full Function Scientific Calculator - The Calculator With A Difference.

No longer do you have to contend with just 4 functions on a calculator. The KSH-1 calculator provides all the functions available on the HP-11C plus more:

- Calculations to 18 digits (17 displayable)
- Ability to insert result directly in foreground program
- Graphically presented (no reference cards needed)
- Program steps and error messages displayed in English
- All stack registers viewable simultaneously
- Operates in hex, binary, octal and decimal modes
- Save/recall programs to disk
- All KSH-1 calculator software is RAM resident (~ 40 to 50K)

Requirements: IBM PC, XT, AT, or true compatible with 128 K; monochrome or color, 1 drive, DOS 2.0 or later

Price: \$49.95 (either plain or 8087 version)
\$59.95 (both versions)

Terms: \$3 shipping, Visa, Mastercard, M.O., check
Tenn. add 7.25% sales tax



K Software House
Software, Service, Consulting
Rt. 2 Box 83B1
Unionville, TN 37180
(615) 294-5090

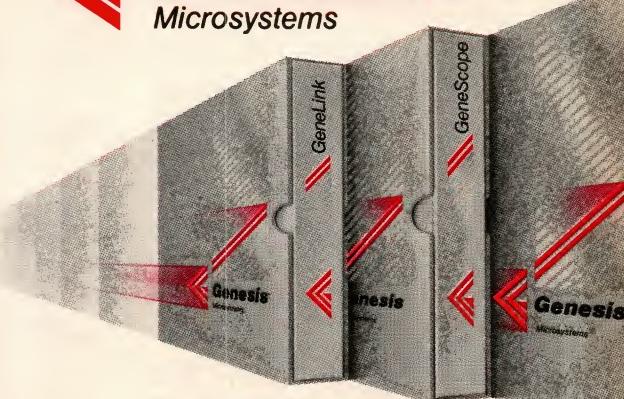
CIRCLE NO. 146 ON READER SERVICE CARD

LINKS FASTER THAN YOU CAN READ THIS AD

New GeneLink™ is up to 20 times as fast as other linker/locators. Enough said.*

*Time's up, but we could use a few extra seconds to tell you it provides a new level of debugging information for GeneScope™, our true source level debugger. Plus intermodule type checking and cross referencing. Supports overlays and unlimited program sizes too. Call us.

(415) 964-9001



196 Castro Street
Mountain View, CA 94091

CIRCLE NO. 223 ON READER SERVICE CARD

INTERNATIONAL DISTRIBUTORS • Germany—München: Instrumatic, Tel: 089/85 802-0 • Spain—Madrid: Instrumatic, Tel: 1/455 81 12 • Switzerland—Zurich: Instrumatic, Tel: 1/723 14 10—
Geneva: Instrumatic, Tel: 022/36 08 30 • United Kingdom—High Wycombe: Instrumatic, Tel: 0494 450 336 • Italy—Milano: Winline, Tel: (2)984 7616
Australia—Oakleigh: Datac Digital Systems, Tel: 03 568 6922

BACK UP YOUR COMPANY'S MOST IMPORTANT PC INFORMATION SOURCE . . .



As your company's "resident PC expert," you're the source for information on IBM PCs—from developing customized applications to recommending software and equipment. You're the one consulted for all the answers.

But when you need answers yourself, where do you turn?

TURN TO PC TECH JOURNAL.

PC TECH JOURNAL is your personal back-up system for the in-depth technical information and programming techniques for IBM personal computers. You can depend on it every month for the most authoritative coverage of innovative applications including LANs, advanced programming languages,

graphics, mass storage, data management...complete with detailed instructions that take you from design stage to implementation.

Subscribe today and save 50%!

Use the attached order card, or call

1-800-852-5200

toll-free for faster service

12 Issues for \$23.70

24 Issues for \$47.40

Savings based on annual newsstand price of \$47.40.

Note: Since your job depends on up-to-date PC information, your subscription may be tax deductible.

PC TECH JOURNAL

Written for IBM PC Experts by IBM PC Experts.

PC TECH JOURNAL—THE TECHNICAL BACK-UP PC EXPERTS NEED



Turn to
PC TECH JOURNAL
for in-depth technical information
and programming techniques
on the IBM PC. It's the most
authoritative coverage available on
advanced applications to help you
in your work. Subscribe today and
save 50%!



YES,

back me up with the technical IBM PC information I need. Please enter my subscription to PC TECH JOURNAL for:

One year (12 issues).
Only \$23.70.

Two years (24 issues).
Only \$47.40.

SAVE 50%!
Savings based on annual newsstand price of \$47.40.

Mr./Mrs./Ms. _____

please print full name

PT 4S424

Company _____

Title _____

Address _____

City _____

State _____

Zip _____

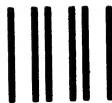
Check one: Payment enclosed Bill me later

Charge my: American Express Visa MasterCard

Card No. _____ Exp. Date _____

Add \$6 a year for postage in Canada and all other foreign countries.

Please allow 30 to 60 days for delivery of first issue.



NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL

FIRST CLASS PERMIT NO. 66 BOULDER, COLORADO

POSTAGE WILL BE PAID BY ADDRESSEE

**TECH
JOURNAL**

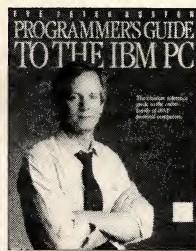
P.O. Box 2966
Boulder, Colorado 80321

Keeping the Family Straight

In his latest book Peter Norton outlines the technical distinctions among members of the IBM PC family; the book does, however, have a few shortcomings.

Programmer's Guide to the IBM PC

Peter Norton (Microsoft Press, Bellevue WA 1985) 426 pages, paper, \$19.95



Peter Norton is widely recognized as a primary authority on the IBM PC. His well-known Norton Utilities, which deal intimately with the inner workings of the machine, demonstrate that this recognition is well deserved. Thus, a new book by this author is worthy of note.

The intended audience for the *Programmer's Guide* is just that: programmers who are somewhat familiar with the system but want to learn more in order to write better programs. Norton says he set out to write both a reading book and a reference book; he has succeeded fairly well in both regards.

A major feature of this book is the pointing out of differences between various models in the PC family: the plain vanilla PC, the PC/XT, the Portable PC, the PCjr, and the PC/AT. Unfortunately, coverage of the AT is somewhat less than complete, and the reader is often referred to the IBM documentation for some of the most significant and difficult details. This leaves the impression that the book was written before the author had fully explored this newest machine, and it detracts somewhat from the usefulness of the book. By contrast, the PCjr (a machine that is now out of production and thoroughly covered in two entire books by Norton) receives extensive coverage.

The first seven chapters cover the basic design of the various models as well as their peripherals: the microprocessors, support chips, keyboards, disk drives, video displays, sound generation (half of this chapter covers the PCjr) and assembly language. It is not,

however, meant as an assembly language tutorial, and it provides just enough information to be dangerous, but not enough for a user to become proficient. Successively lower levels of controlling the system are described: built-in facilities of a high-level language, DOS functions, BIOS services, and direct hardware manipulation. Norton quite sensibly advises the reader to program at the highest level that provides the required level of control.

The major portion of the book, 11 chapters, describes the BIOS and DOS services available to programs through interrupts and function calls. This information is taken from IBM's hardware and DOS technical references, but it is presented in a much more readable format and with some advice on how and why to use each service. In addition, Norton describes some undocumented subtleties he has discovered through experience. However, because of several significant errors and omissions (more on these later), the *Programmer's Guide* cannot totally serve as a replacement for the original documentation. Although in many respects it delves deeper into certain subjects, it sometimes stops short of fully explaining a complicated concept. For example, the following is included in the discussion of the INT 22H terminate address vector: "This is exotic stuff. Don't mess with it if you don't understand it. If you are qualified to use this feature, then you probably understand it better than I can explain it."

The last two chapters deal with programming, specifically with interfacing assembly language routines to high-level languages. They describe the kind of information about linkage conventions and data formats that must be available to implement such interfaces. Three examples are provided: BASIC (both interpreted and compiled, with emphasis on the latter), Lattice C, and IBM/Microsoft Pascal. The information

here largely duplicates information in the respective compiler manuals, but, again, is presented in a much more digestible manner than in the compiler documentation (especially for BASIC).

As mentioned previously, some information included in the book is wrong or incomplete. Readers new to assembly language will be led astray by two errors. First, it is stated that any of the registers AX, BX, CX, and DX may hold an offset address. One program example even contains the instruction MOV AX,[DX] which is patently illegal and will not assemble; only the registers BX, BP, SI, and DI may be used to hold an offset for addressing memory. Second, diagrams that are included to illustrate the use of the stack indicate erroneously that the SP register points to the location into which the next push will occur, instead of the location of the last item pushed.

The description of DOS functions 11H and 12H (find first and next matching files) is wrong. The book implies that the output of these functions (the name of a file that matches a search pattern) is placed into the same file control block (FCB) that contains the search pattern, whereas in fact these functions construct a new FCB at the current DTA (disk transfer address). But information for functions 4EH and 4FH, which perform the equivalent services using path names, is correct.

As for omissions, no good description of the differences between .COM and .EXE files is included. In several places, the author implies that the program segment prefix (PSP) resides in the same segment as the code, without pointing out that this is true only for .COM, not .EXE files. It also is not generally true that files that are convertible from .COM to .EXE format are executable in either format, as the book claims, because in most cases, a program written as a .COM file will crash the system if run as a .EXE.

BOOK REVIEWS

Finally, installable device drivers are mentioned briefly. The appendix devoted to them discusses the ANSI.SYS driver in very general terms. ANSI.SYS and device drivers in general are poorly documented in the DOS manuals, and better information is sorely needed. Perhaps in Mr. Norton's next book.

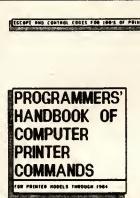
Despite the said errors and omissions, the *Programmer's Guide* is highly useful for anyone with more than a basic understanding of the PC. The advice on writing programs to run on a

wide variety of configurations will be valued by authors of commercial software, and the additional information not available in official documentation is helpful to any user. The book is especially recommended to users with a low-intermediate level of experience who want to progress to high-intermediate. Unfortunately, the book cannot take the reader to the expert level, because it seems to withhold information just when a subject gets interesting.

—TED MIRECKI

Programmers' Handbook of Computer Printer Commands

Edited by Mary Lou East and Fred B. East (Cardinal Point Inc., Ellettsville, IN; 1985) 258 pages, spiral bound, \$37.95



EDITED BY MARY LOU EAST & FRED B. EAST

Those who remember the days before pocket calculators became available also remember books of mathematical and financial tables, filled with endless compilations of logarithms, sines, cosines, and loan repayment factors. Although the silicon revolution has relegated these publications to the scrap heap along with slide rules and carrier pigeons, it has made necessary another type of book of tabulations. The *Programmers' Handbook of Computer Printer Commands* is a prime example of such a volume. No light reading to be found here, just pages and pages of escape sequences and other control codes for more than 100 computer printers.

But don't throw away the printer manual just yet. This book is by no means a replacement (nor does it claim to be). Most printer manuals have a chapter or appendix listing just the control codes, with minimal explanation of how or why to use them. Such a concise summary is useful as a reference only after a user has become familiar with a printer through reading the detailed sections of the instruction manual and operating his printer over some period of time. This book merely reproduces these tables for a large number of printers. It does not provide sufficient information to write a printer driver for a totally unfamiliar printer, but does permit a comparison of differences among similar models. However, as will be explained, trying to use this book to determine which models are similar is not easy.

The title page claims that the book covers printer models through the end of 1984. This may be true, but it has some significant omissions. In the table of contents, several makes are listed with an accompanying notation that information for them was not received from the manufacturers in time for publication. Some of the well-known makes omitted for this reason are Atari, Canon, Data General, Inforunner, Smith Corona, Wang, and, yes, IBM. The book includes a mail-in card inside the front cover for registering each copy for

C Programmer Essentials

"Offers many capabilities for a reasonable price"

W. Hunt, PC Tech Journal

"I highly recommend the C UTILITY LIBRARY"

D. Deloria, The C Journal

C ESSENTIALS

200 functions: video, strings, keyboard, directories, files, time/date and more. Source code is 95% C. Comprehensive manual with plenty of examples. Demo programs on diskette. Upgrade to THE C UTILITY LIBRARY for \$95.

\$100

THE C UTILITY LIBRARY

Thousands in use world wide. 300 functions for serious software developers. The C ESSENTIALS plus "pop-up" windows, business graphics, data entry, DOS command and program execution, polled async communications, sound and more.

\$185

ESSENTIAL GRAPHICS

Fast, powerful, and easy to use. Draw a pie or bar chart with one function. Animation (GET and PUT), filling (PAINT) and user definable patterns. IBM color, IBM EGA and Hercules supported (more soon). NO ROYALTIES. Save \$50 when purchased with above libraries. Available February, 1986.

\$250

Compatible with Microsoft Ver. 3, Lattice, Aztec, Mark Williams, CI-C86, DeSmet, and Wizard C Compilers. IBM PC/XT/AT and true compatibles.

C Compiler Packages: Microsoft C - 319, Lattice or CI-C86 compilers \$329. Save \$40 - \$50 when purchasing compiler and library combinations. Specify C compiler and version number when ordering. Add \$4 for UPS or \$7 for UPS 2-day. NJ residents add 6% sales tax. Visa, MC, Checks, PO's.

ESI ESSENTIAL SOFTWARE, INC
P.O. Box 1003 Maplewood, NJ 07040 914/762-6605

CIRCLE NO. 140 ON READER SERVICE CARD

MAINFRAME TSO/SPF EDITOR ON A PC

HCS/EDITOR only \$49.95

shipping & handling
\$5.00 U.S., \$7.00 Canada, \$13.00 foreign

NOW WITH MORE GOOD STUFF!

including

Can handle files up to 60MB
Record lengths to 2048 Bytes
Macros
File access over 4 times faster

Heuristic Computer Systems

853 Hickory Drive
Carmel, IN 46032
(317) 848-8981

IBM is a registered trademark of International Business Machines

CIRCLE NO. 144 ON READER SERVICE CARD

fileMASTER THE DISK UTILITY

```
fileMASTER
Filename: sample.txt Segment: 000000
Offset 0 1 2 3 4 5 6 7 8 9 A B C D E F 8123456789ABCDEF

0000 54 68 69 73 28 69 73 28 61 28 73 61 6D 78 6C 65 This is a sample
0010 28 6F 66 28 6B 65 28 44 69 73 78 6C 61 79 28 of the Display
0020 53 63 72 65 6E 2E 28 45 61 63 68 28 28. Screen. Each
0030 62 79 74 65 28 69 73 28 73 68 6F 77 6E 28 69 6E byte is shown in
0040 48 45 58 41 44 45 43 49 4D 41 4C 28 6F 6E 28 HEXADECIMAL on
0050 74 68 65 28 66 65 66 74 28 61 6E 64 28 69 6E 28 the left and in
0060 41 53 43 49 48 28 69 6E 28 71 68 69 73 28 28 ASCII in this
0070 61 72 66 61 28 28 54 68 65 28 47 66 66 73 65 74 area. The Offset
0080 28 76 61 6C 75 65 73 28 78 72 6F 76 69 64 65 28 values provide
0090 64 69 73 78 6C 61 63 65 6D 65 66 74 28 69 6E 2D displacement in-
00A0 74 6F 28 74 68 65 28 73 65 67 6D 65 6E 74 2E 28 to the segment.
00B0 54 6F 28 63 68 61 6E 67 65 28 64 61 74 61 2C 28 To change data,
00C0 61 75 73 74 28 74 79 78 65 28 6F 76 65 72 28 28 just type over
00D0 74 68 65 28 48 45 58 28 6F 72 28 41 53 43 49 49 the HEX or ASCII
00E0 64 61 74 61 2E 28 28 28 28 28 28 28 28 28 28 data.
00F0 80 81 82 83 84 85 86 87 88 89 8A 8B 8C 8D 8E 8F ..... Values: Hex=54 Bin=01010100 Dec=884 Asc=C7
```

1 Hex 2 Ascii 3 Display 4 Edit 5 Find 6 Go To 7 Print 8 Help 9 Write 0 Undo

FINALLY!!

A Disk Utility for the IBM-PC
that's fast and easy to use.

- FILE MODE
- DISPLAY
- PRINT
- MODIFY
- HARD DISK
- SECTOR MODE
- BROWSE
- SEARCH
- DOS 1.1 to 3.1
- FLOPPY DISK

ONLY \$39.95 +\$3.00 SHIPPING, CA +6.5% TAX

J. L. SCHULLER & ASSOCIATES (818) 366-6934
148 Rinaldi St., Suite 6, Mission Hills, CA 91345

CIRCLE NO. 228 ON READER SERVICE CARD

MARCH 1986



New for IBM PC/XT/AT low cost mag tape subsystem

- Fast controller — 40Kbytes/second
- New MAINSTREAMER™ tape drive
- Small size, lightweight

Send for our complete drive and interface manuals so you can evaluate and compare. Only \$25 for both.

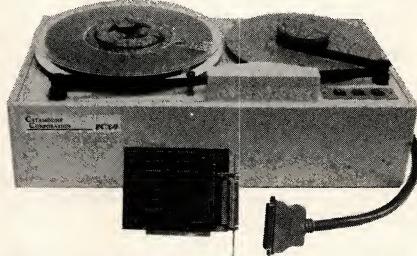
Tape systems are also available for all other RS-232-C interfaces. Call or write attn: IBEX Applications Engineer today.

I B E X

Right for the times
IBEX COMPUTER CORPORATION
20741 Marilla St., Chatsworth, CA 91311
(818) 709-8100 TWX: 910-493-2071

CIRCLE NO. 149 ON READER SERVICE CARD

PC ◊◊ MAINFRAME VIA 9-TRACK TAPE



For Information Interchange — Backup Archival Storage ...

IBM format compatible 9-track, 1/2 inch magnetic tape is the universally accepted media for mainframes and minicomputers. Now Catamount offers Low Cost, Lightweight 9-track Tape Subsystems for the IBM-PC/XT/AT computers which allow:

- Reading tapes generated on mainframes and minicomputers.
- Writing tapes to be read on mainframes and minis.
- ASCII, EBCDIC and Binary tapes accommodated.
- 800 bpi NRZI, 1600/3200 bpi PE, and 6250 bpi GCR format systems available.
- Storage capacities up to 180 MB on a single reel.

Systems come complete with comprehensive DOS command syntax oriented software and an Installable Device Driver. For OEM applications, the tape controller is available separately.

**CATAMOUNT
CORPORATION**

2243 Agate Ct. • Simi Valley, CA 93065-1898
(805) 584-2233



CIRCLE NO. 111 ON READER SERVICE CARD

195

Does your disk look like THIS?



Let **HD TUNEUP** cleanup your act!

HD Tuneup reallocates all files on a disk into adjacent clusters, speeding up your file and program loads.

HD Tuneup leaves all of the free space on your disk in one area so that your new files may be allocated contiguously.

HD Tuneup speeds directory searches by placing all directories adjacent to each other and eliminating deleted entries. Files in the same sub-directory are moved adjacent to each other, minimizing head movement between files during disk intensive applications.

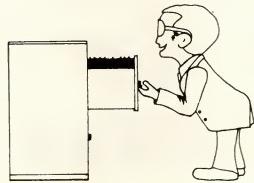
HD Tuneup requires PC compatibility, DOS 2.x/3.x and 196k. Hard drives up to 32mb may be tuned, along with any diskette.

AVAILABLE NOW

for \$39.95 + \$3.00 s/h

SofCap Inc.

P.O. Box 131
Cedar Knolls, NJ 07927
Visa (201) 267-0848 M/C
N.J. residents add 6% sales tax.



CIRCLE NO. 164 ON READER SERVICE CARD

Excellence

In your job, it depends on having the best tools available at your disposal. With such tools, your productivity increases and your work becomes easier.

Wisely, you keep a sharp eye open for products using the latest technology.

You have now located the source of advanced debugging technology for PC-DOS.

More powerful debugging software is not available anywhere...at any price. Yet the cost is affordable to even the smallest budget.

DSD-86...New and innovative design combines the most sophisticated user interface with the most flexible display to create a new generation of debugging technology for the IBM PC. Only 69.95



SoftAdvances

P.O. Box 49473 - Austin, Texas 78765 - (512) 478-4763

Visa & Mastercard Accepted.
Please include 4.00 for shipping and handling.

CIRCLE NO. 214 ON READER SERVICE CARD

TURBO EDITASM

Introducing the first co-resident editor assembler for the IBM PC family.

TURBO EDITASM (TASM) is significantly faster and easier to use than the IBM Macro-Assembler (MASM). Whether you are new to assembly language and want to quickly write a small assembly language routine, or are an experienced MASM user tired of waiting months to assemble large files, **TURBO EDITASM** will bring the excitement back to assembly language.

TURBO EDITASM IS MUCH FASTER:

- How fast is **TASM**? The graph below shows relative assembly times for a 48K source file. For large files like this we blow MASM's doors off at 3 times their speed. For smaller 8K files we positively vaporize them at 6 times their speed.

TASM (110 sec.)
MASM (340 sec.)

- **TURBO EDITASM** is faster for the following reasons: (1) Written entirely in assembly language (unlike MASM). (2) Editor, assembler and source file always in memory so you can go instantly from editing to assembling and back. (3) Eliminates the time needed to LINK programs. Executable COM files can be created directly. (Also creates OBJ files compatible with the IBM linker).

TURBO EDITASM IS EASIER TO USE:

TASM includes many other features to make your programming simpler.

- Listings are sent directly to screen or printer. Assemblies can be single stepped and examined without having to leave the editor.
- Access the built-in cross reference utility from the editor.
- Full support of 186 and 286 (real mode) instructions.
- Both Microsoft and 8087 floating point formats are supported. 8087 and 287 instructions supported directly without macros for faster assembly.
- Calculator mode: Do math in any radix even using symbols from the symbol table.
- Direct to memory assembly feature lets you test execute your code from editor.
- Coming soon: A coordinated symbolic debugger.

COMPATIBILITY: **TASM** is source code compatible with MASM and supports macros, records and structures.

**Introductory Price \$49
With .OBJ Capability \$99**

Speedware™

IBM,

Microsoft trademarks of IBM Corp.,

Microsoft Corp.

Include \$5.00 shipping and handling. California residents add 6% Sales Tax.

Dealer Inquiries welcome
916-988-7426

118 Buck Circle, Box T
Folsom, CA 95630

Microsoft Corp.

CIRCLE NO. 190 ON READER SERVICE CARD

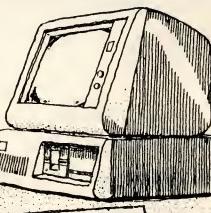
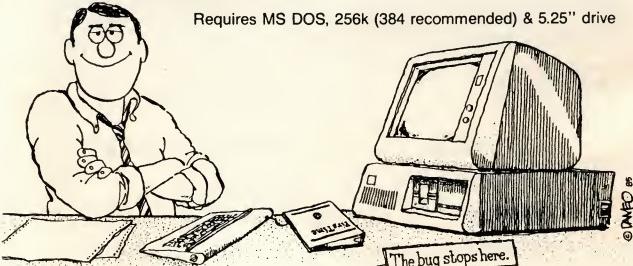
The First Idea-Processor For Programmers.

FirsTime™

Has features no other editor has.

- Fast program entry through single keystroke statement generators
- Fast editing through syntax oriented cursor movements
- Dramatically reduced debugging time through immediate syntax checking.
- The error checking is thorough and includes semantics • Undefined variables, types and constants • Assignment statements with mismatched types
- Errors in include files and macro expansions
- Automatic program formatter (you specify the rules)
- Split Screen editing
- Reading a file with errors moves cursor automatically to point of error
- Unique programmer-oriented features
 - zoom command gives top-down view of program logic
 - view macro command shows expansion of a C macro in the editor
 - view/update include file allows you to view and update an include file
 - transform command allows you to transform statements to related ones
 - search for next error command

Requires MS DOS, 256k (384 recommended) & 5.25" drive



To Order Call: (201) 741-8188 or write:

SPRUCE TECHNOLOGY CORPORATION

P.O. Box 7948
Shrewsbury, NJ 07701



FirsTime for Turbo Pascal \$ 74.95
FirsTime for dBase III \$125.00
FirsTime for MS-Pascal \$245.00
FirsTime for C \$295.00

FirsTime is a trademark of Spruce Technology Corporation. MS DOS is a trademark of Microsoft Corporation. IBM is a trademark of International Business Machines Inc.

* Turbo Pascal is a trademark of Borland International * dBase III is a trademark of Ashton Tate

CIRCLE NO. 242 ON READER SERVICE CARD

BOOK REVIEWS

error corrections and information regarding the availability of updates.

Another problem is that the information on the printers covered is not always as complete as it should be. Code sequences of the type ESC X n do not specify the format of the number n: whether it is binary, decimal, ASCII, etc. Some attempt is made to describe the format of these numbers used by Qume-compatible printers, but it is far from complete. For Hewlett-Packard printers, one table of codes is divided into the three levels of sophistication for basic print and space, data processing, and advanced document processing. This table is meant to cover all HP models, but no indication is given as to which models support which capabilities. Further, the Thinkjet's Epson-compatible mode is not even mentioned.

The aforementioned shortcomings are specific in nature; the book's most serious drawback is that it does not summarize or classify the mass of information contained in these tables. Even though standardization of printer codes has a long way to go, several large families of printers that use similar codes are recognized within the industry. Among dot-matrix printers, the Epson standard is preeminent (even IBM subscribes to it), while Qume and Diablo rule the daisy-wheel world. The classification of printers into these broad categories would greatly assist the user in integrating an unfamiliar printer into a system; as it is, any similarities must be deduced by careful perusal of the code tables. Other information that would concisely characterize the differences among printers is the minimum horizontal and vertical motion increments. If the printer manufacturer does not provide such information directly, it should be the editor's responsibility to ferret it out of the data provided.

Granted, the editors who take on the job of compiling this volume of information have a thankless task. When reading a how-to narrative, the reader remembers the good points from the text, but in using reference tables, he more likely will remember only the difficulties that he encountered when trying to locate the desired information. And in this reference, the difficulties are plenty. *The Programmers' Handbook of Computer Printer Commands* can be a serviceable aid to the user who needs to work with a variety of printers, but only if that user is already familiar with a good number of them.

—TED MIRECKI



**We firmly believe that
Vitamin C is the best data
entry and windowing package
available - bar none. In fact, we
are so confident that once you see
Vitamin C you'll agree, we are offering a**

100% MONEY BACK GUARANTEE

Finally! A library of high level C functions (not just a bunch of building blocks) designed to increase your productivity and help develop superior applications in dramatically less time! How? Well, VITAMIN C automatically coordinates complex tasks and leaves the programmer free to be creative! With VITAMIN C, for example, you'll never even have to think about saving or restoring portions of the screen when a window is opened, moved, or closed. Simply call wopen(), wmove(), or wclose() and VITAMIN C takes care of the complexities. It's just that easy! This philosophy of relieving the programmer from so many details as possible runs throughout VITAMIN C. As a result, jobs that used to take days to code can be finished in a matter of hours!

Complete Input formatting • Unlimited validation • Full attribute control
Insert & delete • First/last/next/previous field • Field sensitive help interface
Multiple virtual windows • Automatic overlay and restore • Full collision protection
Animated "zoom" windows • Move, grow, or shrink windows at the press of a button
Bordered or borderless windows • Automatic or manual scrolling • Hide and show
Print to or scroll background windows without hurting foreground

PLUS: All data entry features are already interfaced with windows for effortless data entry windows, display windows & pop-up menus!

Vitamin C \$149.95 + \$3 Ground, \$6 Air, \$15 Next day. Texas add 6 1/8 % sales tax. Specify Microsoft v3, Lattice, Computer Innovations, DeSmet, Aztec, Mark Williams. Call about UNIX, TI-Pro, and others! <ul style="list-style-type: none">• 100% source code • Reference manual •• Step by step Tutorial • Examples •• Sample Programs •	For orders or information, call... (214)243-6197 Or write... Creative Programming Box 112097 Carrollton, Tx 75011-2097
---	--

CIRCLE NO. 107 ON READER SERVICE CARD

Make your PC or AT into a COMMUNICATING WORKSTATION for only \$85

**Use ZAP, the Communications System for Technical Users
COMPLETE Communications for PROGRAMMING and ENGINEERING**

EMULATION of graphics and smart terminals is combined with the ability to TRANSFER files reliably, CAPTURE interactive sessions, and transmit MESSAGES while also being able to swap between your mini or mainframe session and your PC application. SUSPEND a line to run a PC application. Reconfigure features to fit the communications parameters and keyboard requirements of the host computer software. Complete technical documentation helps you understand and fit ZAP to your style.

HIGHLIGHTS OF ZAP:

- Emulate TEKtronix 4010/14 and DEC VT 100, 102, 52 including variable rows and columns, windows, full graphics, even half tones.
- Reliable file transfer to/from any mainframes and PCs including KERMIT and XMODEM protocols plus you get a full copy of KERMIT. Transfer speeds ranging from 50 to 38,400 BAUD. Session control include printer dumps and save to disk.
- MACRO and Installation files ("scripts") controllable by you.
- EMACS, EDT and VI "Script" files are included. ZAP is also used with other popular software including graphics products like DISSPLA and SAS/GRAF.
- CONFIGURABLE to communications, terminal features on the "other end"; 1, 2 stop bits; 5, 6, 7 or 8 data bits; parity of odd, even, none, mark and space; remap all keys including the numeric pad and standard keyboard, set any "virtual" screen size.
- Full PC/MSDOS access to run any command or program that will fit in your systems memory. ZAP takes less than 64K.
- 9 Comm ports are supported by ZAP. Plus full color in text and graphics make use of the IBM color, EGA cards, or Hercules Monochrome.

**ONLY
\$85**

Full refund if not satisfied
during first 30 days.

**Solution
Systems**

335-P Washington St.
Norwell, Mass. 02061
617-659-1571
800-821-2492

CIRCLE NO. 130 ON READER SERVICE CARD

TECH BOOK

ACCESSORIES/SUPPLIES

DISK SALE

DS/DD for IBM-PC & compatibles w/sleeves & labels—10/\$8.50—bulk 100/\$67. DS/HIGH DENSITY for IBM-AT w/sleeves & labels 10/\$24.00—bulk 100/\$215. PREMIUM QUALITY, LIFETIME WARRANTY! MONEY-BACK SATISFACTION GUARANTEE! send check or pay by MC/VISA/AE. \$3 shipping +\$2 if COD. Unitech

20 Hurley St.
Cambridge, MA 02141
(617) UNI-TECH

•• SOFTWARE PUBLISHING ••

GDS offers a wide variety of services that will help get your software to the market. Address your needs with GDS.

- IBM style cloth/vinyl 3-ring binders/slips
- Labels, sleeves, disk pages ...
- Disk duplication with 100% verification
- Bulk diskettes
- Shrink wrapping and assembly
- Quick turnaround

A well-packaged product can make the difference in making a sale. Call us NOW. VISA/MC Glenco Development Systems
3920 North Ridge Avenue
Arlington Heights, IL 60004
(312) 392-2492

BUSINESS OPPORTUNITIES

Personal Computer Owners
CAN EARN \$1,000 TO \$5,000
monthly selling simple services performed by their computer. Work at home-in-spare time. Get free list of 100 best services to offer. Write:
C.I.L.B.Q.
PO Box 60369
San Diego, CA 92106-8369

HARDWARE/ADD-ON BOARDS

SPEECH SYNTHESIS

SynPhonix: TRUE Unlimited Speech Synthesizer for IBM-PC/XT/AT/jr & compatibles. This low power short card includes an SSi263 speech chip, amplifier and speaker. Software includes Text-to-Speech, Phonetic Editor, Talking Clock & demos. Can be programmed with BASIC and other languages. Prices start below \$200.

SynPhonix™

Electronic Speech Articulator

Artic Technologies
2234 Star Court
Auburn Heights, Michigan 48057
(313) 852-8344

RS-232/RS-422 Communications

Versatile communications and I/O boards.
—Four port RS-232 with DOS drivers \$349
—RS-422/485-serial interface \$149
—RS-232/422 with 24 parallel I/O \$199
—RS-422 synchronous with DMA \$299
—delivery from stock
—Custom designs available

adams

Adams Incorporated
P.O. Box 17525
Greenville, SC 29606
(803) 297-9630

HARDWARE/DISK DRIVES

8 INCH DISKETTE SYSTEM

Read, write and format diskettes from IBM mainframes, minicomputers, data entry equipment, etc. Complete easy to use software handles EBCDIC conversion. Can read and write CP/M 8-inch diskettes (many formats). You also can use 8-inch drives for PC DOS files; 1200 KB per diskette! \$1150 complete.

MicroTech Exports
644 Emerson St. Suite 8
Palo Alto, CA 94301
(415) 324-9114

HARDWARE/PERIPHERALS

A/D TO RS232 CONVERTER

Low cost stand-alone data acquisition board for any 8 bit RS 232 port. 8 channels, 8 bit conversion. 0-5V input, 300-9600 baud. Small size, 4" x 5", with wall plug power supply. Easy-to-use, includes sample driven software listings. Kit w/all parts & PS, \$59.95 + \$4 shipping. Assembled & tested is \$89.95 + \$4.

TPS SYSTEMS
14820 Elmwood Road
Anchorage, AK 99516
(907) 345-6730

SCSI-PC HOST ADAPTER

Plug & Play installation for SCSI Optical/Hard disk and tape peripherals. Wide selection of SCSI peripherals selectable by manufacturer and model No. via menu window. Absolutely NO driver software need be written by the user. Price is \$249. for board, SCSI bios prom and floppy based configuration data.

Advanced Storage Concepts, Inc.
9660 Hillcroft #325
Houston, TX 77096
1-800-423-9175 (713) 729-6388

NEW!...CIP/35 CONTROLLER

- 8-300 volt 20 amp SPDT relays
- 8 Opto-isolated digital inputs
- 8 Bit A/D Converter w/Mux capability
- RS-232 or TTL serial—Remote Reset func.
- 6MHz 8035 CPU—Onboard Counter
- LED indicators—12 volt AC/DC operation
- Price is ONLY \$225.00—Same day shipping

DATA MANAGEMENT SYSTEMS, INC.
2141 Centennial Road
Salina, KS 67401
(913) 823-6440

NEW! OVERTHRUSTER™

- Guaranteed 60% Speed increase (7.38 Mhz)
- 100% Compatible with all PC software
- Includes 8Mhz NEC V-20 CPU and Hardware reset
- Norton Utility Sysinfo rating of 2.8
- No expansion slot needed—easy to install
- This is not just a CPU replacement. Call for complete details. —Dealers welcome.
- Price is ONLY \$195.00—Same day shipping

DATA MANAGEMENT SYSTEMS, INC.
2141 Centennial Road
Salina, KS 67401
(913) 823-6440

640K YOUR MOTHERBOARD!!

Put 640K of RAM on Your Motherboard! NO SLOT! NO ADD-ON BOARDS!—NO SOLDERING! Complete w/ALL Hardware, Memory Chips and Instructions. Easy PLUG-IN Installation. Avail for: IBM XT, IBM Portable, COMPAQ & COMPAQ PLUS Portables. Only \$144.95 + \$5 S/H. Specify computer when ordering. Dlr. inquiries invited. CK/MO/VISA/MC

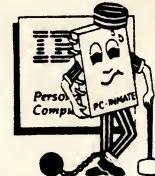
J S & J Software
1281 S. King St. Suite 6A
Honolulu, Hawaii 96814
24/hr Orders: (800) 821-5226 ext. 435

PC SPEEDUP

Up to 45% speed improvement for IBM PC and clones. 100% compatible, easy installation. Kit includes NEC V20 or V30 Chip, Tool, User Guide, Warranty, free Multiuser BBS Access. V20-5 mhz for PC, V20-8 and V30 in stock. V30 replaces 8086. Call for Turbo 7 and VP/M. From \$4 to \$89. Tech info 414-242-2165 Exec-PC, Inc.
PO Box 11191 Shorewood, WI 53211 Order on BBS: Orders: 414-242-2173 414-964-5160

TURBO START YOUR PC!!!

FOR IBM PC's ONLY! The PC-INMATE, a Firmware ROM Module for the IBM-PC!!! Features: BOOT within 10 SECONDS!!! BREAK the 640K BARRIER!! Access up to 704K of RAM!!! (Lotus, DOS, etc.) SCREEN RELIEF—protects your monitor, and MORE!! Easily PLUGS IN-NO SLOT! Only \$49.95 + \$3 S/H. Dlr. inquiries accepted CK/MO/VISA/MC.



JS&J Software
1281 S. King St. Suite 6A
Honolulu, HI 96814

24 hr Orders Only: (800) 821-5226 ext. 435

BAR CODE READERS

IBM PC/XT, AT Keyboard or RS-232 interface

- No programming required for IBM models
- Auto-recognition and single code decoding
- Reads dot matrix & preprinted labels
- Reads Code 39, UPC A/E, Codabar & 12 of 5
- \$635 list, units in stock, 2 year warranty
- Bar code printing software, call for info.

PERCON, Inc.
2190 W. 11th
Eugene, OR 97402
(503) 344-1189

NEW!...AT SpeedSwitcher™

- Switchable between 6 speeds of operation 4-11Mhz (39 to 70% speed increase)
- 100% PC & AT software compatible
- Speeds up your entire software library
- No expansion slot needed—easy to install
- Call for complete details—Dealers welcome
- Price is ONLY \$125.00—Same day shipping

DATA MANAGEMENT SYSTEMS, INC.
2141 Centennial Road
Salina, KS 67401
(913) 823-6440

HARDWARE/SECURITY

STILL WAITING? INSECURE?

QUICKON—Instant Turn-on module—\$69.95. LOCKIT I—Password Boot-Up module—\$129.95. User selectable PW & Boot-only-from-HD mode. PC RESET—Reboot w/o cycling power—\$21.95. Easy to install, No slot, specify PC/XT/AT LOCKIT II—PW protection for sub-directories, for DOS 2.0 & up.—\$79.95. MC/VISA Security Microsystems Consultants
16 Flagg Place Suite 102 TJ
Staten Island, NY 10304
(718) 667-1019

RATES AND INFORMATION

Standard listings consist of a bold lead line (2.3 characters maximum); 7 lines of body copy (45 characters per line); 4 lines for company name, address and telephone number. \$140 per insertion—3 issue minimum. Additional charge for extra lines and company logos. Prepayment and frequency discounts available. American Express, MasterCard, Visa accepted. Copy subject to publishers approval. Send typewritten or printed copy, reproducible logo art (if applicable) and remittance to Kathryn Cumberland, Classified Sales Manager, Ziff-Davis Publishing Company, One Park Avenue, New York, NY 10016. For additional information, assistance, or to place an order by phone, call collect (212) 503-5115.

TECH BOOK

SOFTWARE/BAR CODING

BAR CODE PRINTING/READERS

PRINT Bar Codes on PC and Epson/Okidata or IBM Proprietary—Code 39, 1 2of5, UPC, MSI, LOGMARS, AIAG, HIBC. Graphics chs up to 1" Labels, Catalogs from disk files. Subroutines for BASIC, Pascal, T-Pascal, C. Programs \$49-\$299. Readers/portable (\$350), fixed (\$595). Worthington Data Solutions
130 Crespi Court
Santa Cruz, CA 95060
(408) 458-9938

SOFTWARE/BUSINESS

>timeslips<

Pop-up stopwatch screens allow traditional time & expense entry or real-time tracking of programmer, compilation, assembly, job & online time. • Create professional bills: 114 formats with auto aging, flat fee, & more. • Generates reports, graphs, pie charts, mailing labels & IRS usage log. • Projected completion time entry allows instant analysis of project & budget status. • Not copy protected. • \$99.95 + \$7.00 s/h.



North Edge Software Corp.
P.O. Box 286
Hamilton, MA 01936
(617) 468-7358, 1-800-225-5669

SOFTWARE/COMPILER

DeSmet-C - \$109

Full K&R C compiler, linker, librarian, fullscreen editor, profiler, overlays, example software, 140 page manual. BOTH 8087 and floating point libraries. OUTSTANDING PRICE/PERFORMANCE. Consistently rated 1st or 2nd in published benchmarks. PC/MSDOS. No royalties on generated code. Newsletter. Updates \$20 ea. \$109 shipping included. Symbolic (C source level). Debugger Option \$50 extra. C Compiler for the Macintosh \$150.

C WARE CORPORATION
Dept. PCTJ
P.O. Box C
Sunnyvale, CA 94087
(408) 720-9696

SOFTWARE/COMMUNICATIONS

KERMIT, Xmodem, VT100/102

Order now and receive free CommSpeak update when available, or send for more information. Find out why informed buyers at Abbott Labs, Hughes Aircraft, Lawrence Livermore Labs, Stanford University, and The University of Arizona have all purchased multiple VersaCom licenses. Costs \$55.00 plus \$5 s/h. Solution Software
3421 North 1st Avenue #120
Tucson, AZ 85719
(602) 323-0841

SOFTWARE/DATA ENTRY

DATA ENTRY EMULATOR

Full speed heads-down data entry with two-pass verification for the PC/XT/AT & compatibles. Easy screen formatting by your data entry operators in minutes. Loaded with features like: Auto dup & skip, verify bypass, constant fields, range checks, table lookups, full screen paging, & field totals. Fully menu driven only \$395. Call for free 30 day trial period. Computer Keyes
6519 193 SW
Lynnwood, WA 98036
(206) 776-6443

SOFTWARE/DEVELOPMENT TOOLS

COLOR, CURSOR CONTROL

DATE/TIME, KEYBOARD, PEEK, POKE, COMMAND LINE ACCESS, and more available for IBM/MS FORTRAN, IBM/MS PASCAL, and GENERIC (MS) BASIC on PC/DOS and many MS/DOS machines. No redistribution fees. \$47 U.S. MN residents add 6% sales tax. BARTSUBS by BARTSOFT

3210 Lake Shore Boulevard
Wayzata, MN 55391
(612) 473-4032

REVISION CONTROL SYSTEM

The Software Revision Management System™ stores all versions of source/documentation in a single ASCII file. Allows retrieval of any version of source and application of changes, while recording when, why and where changes were made with no duplication of common code. MS/PC-DOS 2.0 \$99.95 + \$5 s/h. (MN + 6%) MC/Visa.
QUILT™ COMPUTING
7048 Stratford Rd.
Woodbury, Minnesota 55125
(612) 739-4650

CONTEXT-SENSITIVE HELP

TRUE/Helper adds context-sensitive help to existing programs. No access to program source is necessary. Works as a pop-up under the target program. Help text can be built using any editor. Text is compressed to reduce space. Works with most custom and off-the-shelf software. \$39.95
GRW Software
P.O. Box 440007
Houston, Texas 77244
(713) 556-9878

ROMable CODE on PC!

PCLOCATE allows PC users to develop ROM-based software from MS-DOS "Exe" files. The user specifies the physical location of all segments. Output files are compatible with most PROM programmers. PCLOCATE supports the 8086, 8088, 80186, 80188, and 80286 processors. MC/VISA.

ALDIA SYSTEMS INCORPORATED
P.O. Box 37634
Phoenix, AZ 85069
(602) 866-1786

SOURCE CODE LIBRARY

... "Structuring BASIC Programs" comes with:
... BASIC examples on DOS 2.0. Diskette.
.... BASIC Check Writing Program.
..... BASIC Source Code Library
..... HOW to Structure Package only \$9.95.
FREE Fact Sheets.

FREE Contract Programmer Registration.
TULSA COMPUTER CONSORTIUM (TCC)
P.O. Box 707
Owasso, OK 74055
(918) 747-0151
Requires 100% compatible, DOS 2-3, Turbo Pascal 2-3 for compatibles.

MATIS/T FOR TURBO: \$29.95

Create large virtual screens; formatted input field; windows for single or multiple screen display. Total control of video attributes. Memory resident Assembler routines used as PROCEDURES in TURBO PASCAL. Also available for BASIC, C, MS-PASCAL, & Assembler. MATIS \$49.95. Royalty FREE. Add \$5 s/h. VISA/MC. CA add tax. SOFTWARE, INC.
500 Sutter St. Suite 222TL
San Francisco, CA 94102
(415) 397-4666

REALIA COBOL SITES

REALFORM is the Screen Handler you have been looking for. It features interactive screen design, an on-line forms editor, relief of cursor control, expedites screen generation, supports numerous data field types, is easy to use and offers powerful data entry functionality. \$395. US. CHARANDON COMPUTER SYSTEMS INC.
1600 Laperriere Avenue
Ottawa, Ontario, Canada K1Z 8P5
(613) 729-3003

INSIDE—DISASSEMBLER

Get INSIDE your PC, XT, and AT software with the disassembler for the 8086/8088, 80186, 80286, 8087 & 80287. INSIDE generates address labels, listings and X-REF table. Write code to disk in "macroassembler" form. Command driven; simple to use. INSIDE and manual only \$49.95 plus \$3.00 s/h (IA res. add 4% tax.)

Inside
DisAssembler

BLACKRIDGE CORPORATION
P.O. Box 385
Bettendorf, IA 52722
(319) 355-4465

BETTERTOOLS FOR BETTERBASIC

BetterTOOLS™ 100 procedures & functions that speed BetterBASIC™ development. Sorting, scrolling, extended math functions, video routines, disk directories, formatted screen display, on-line error descr., input w/full editing & extended code trapping, much more. BetterTOOLS™ w/source & manual, \$89. Write: Software Associates
6220 W. Airport Blvd.
Houston, TX 77035
(713) 726-0706

CPM-80 LIVES ON YOUR PC

CP/Mulator puts a 4mhz 8 bit CP/M emulator in your IBM PC for \$99.
—A great 8 bit development system
—Saves expensive CPM-80 applications
—Increases PC speed 10% for 8088 programs
—Priced less than most software only products
—Used no valuable board slots
Source Information
P.O. Box 2974
Warminster, PA 18974
Phone: (215) 628-4719

CPU MONITOR—\$33.75

Selectively monitors and reports CPU usage for application programs, DOS, ROM's and BIOS. Command and application program interfaces provided. Bar chart output (mono or color). Online HELP. Documentation with examples. Less than 1% overhead and 1K of resident memory. Check or Money order.

Syba Corp.
P.O. Box 272938
Tampa, FL 33688-2938
(813) 885-1972

FIRMWARE PRODUCTION ON PC

LINK&LOCATE enables PC users to produce ROM-based firmware for 8086/87/186 from object files generated by C, PL/M compilers & MASM. Provides full control of segments placement anywhere in memory. Supports output of INTEL hex file for PROM programmer, absolute object file for symbolic debugger & ICE, and MS-DOS EXE file. Includes an INTEL compatible linker, locator, librarian and hex formatters. \$350. Systems & Software, Inc.
3303 Harbor Blvd., C11
Costa Mesa, CA 92626
(714) 241-8650

TECH BOOK

BTTREES IN C SOURCE

BTTree.....	\$75.00
• fast and portable	
• duplicate keys	
• variable length records	
ISAM.....	\$40.00
• works with BTTree	
• simple, powerful application file system.	
Snake	\$59.00
• Similar to UNIX make	
• supports nested macro, file name expansion.	
All three	\$149.00
ALL SOURCE CODE INCLUDED, NO ROYALTY FEES.	Call or write for more information.

SOFTFOCUS

Softfocus
1343 Standbury Drive
Oakville, Ontario, Canada L6L 2J5
416-825-0903

ASSEMBLY PROGRAMMERS, YOUR LIBRARY IS HERE.

Graphics, Floating Point Math, Trigonometry, Widows, 8087 Support, and much more. Over 160 functions for the DOS environment. Written in MS Assembly Language. No Royalties Required. Now included FREE, FSEDIT- Full screen editor. The programmer's file editor. Required IBM PC/XT/AT or compatible. ASMLIB with complete source code and 211+ page manual and FSEDIT \$195.00. Call or write for information.
BC Associates
13073 Springdale St., Suite 134, Dept PT
Westminster, CA 92683
(714) 741-3015

MACROKEY 2.0

Imagine: 720-key keyboard, 65536-char macro buffer, 4 modes of definition, KB security, reset information, powerful macro commands windows popup instantly from any program to perform virtually any Prokey, Superkey features and more. Check/money order. \$49.95 or \$160 W/ ASM source. PC/XT/AT true compatibles.
COMPUTEK
40 West 32nd Street. P.O. Box 20211
New York, NY 10001-9992
(212) 206-6303

ADVANCED FULLSCREEN DEBUG

THE user-friendly debugger that shows all information on a well structured screen. RESIDENT operation and extensive conditional breakpoint feature. Pop-up by Ctrl-Esc, INT-3, conditional breakpoints, or NMI-signal. Fast conditional trace, recording instructions and register contents. Full 286 on-line assembler & disassembler with scroll up/down. Send trace records, disassembled code, and data to printer or file. 1 or 2 monitor operation. Keyboard macro support. Written in MASM, fast & compact (64K). DOS 2.0, IBM PC/XT/AT. \$110 + \$5 s&h.
PUTTKAMMER Software

242 RD 1 Hillcrest LA Nelkenstr 4
Rhinebeck, NY 12572 7031 Weil-3W.
Germany
(914) 876-7830 (Germany) 7031-5226

NEW MS-DOS DISASSEMBLER

MASTER*KEY is intelligent: instantly and automatically producing fully-documented assembly language segmented source files from any COM or EXE file. MASTER*KEY has a Cross-Reference identifying all branch addresses, labels, symbols, functions and interrupts. \$49.95 + \$3 s/h (+6½% tax in CA) VISA/MC
Sharpe Systems Corp.
2310 "E" Street
La Verne, CA 91750
(714) 593-9998

REPORT WRITER

All-language qPLEX-IV lets you select or sort your own special forms, reports, labels, bar graphs or queries. Exports your reports to spreadsheets and wordprocessors. Reads Basic, Assembler, Pascal, C, Fortran, Cobol, ASCII, Data Base Managers and more. Dealer demos available.
MS-DOS, XENIX, UNIX
Snow Software Corporation
3330 Fisher Road
Clearwater, FL 33519
(813) 784-8899

C-INDEX

C-INDEX is a state-of-the-art data management library for C. Designed for serious product development. No Royalties. B+-Tree, variable length records, multiple keys, and transportable source code. Call for our free info packet.

C-INDEX/PRO \$195 Partial Source
C-INDEX/PLUS \$395 Full Source
TRIO SYSTEMS
2210 Wilshire Blvd. Suite 289
Santa Monica, CA 90403
213-394-0796

COPY PROTECTION BY MSD

The ULTIMATE diskette copy protection system designed for software developers and publishers. All IBM PC and XT environments are supported which includes DOS, BASIC (compiled and interpretive) Pascal, P-System, dBASE II and stand-alone systems. Customized systems available. Requires 64K, two disk drives.

Cdebugger

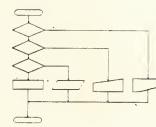
a high level language debugger

MICRO SOFTWARE DEVELOPERS, INC.

214½ West Main St.
St. Charles, IL 60174
(312) 377-5151

FLOWCHARTS BY PROFLO

The fast, friendly, flowchart drawing program for the software professional. PROFLO speeds software development and reduces documentation costs. Lets you create, edit, and print clear, precise flowcharts, quickly and easily. Requires IBM PC (or clone) with DOS, 128K, graphics monitor & graphs printer. Program & Documentation \$49.94. Demo Disk \$10.00.



Star System
28 Topstone Drive
Bethel, CT 06801
(203) 744-0546

Exceptions/Tasks For C

Add Ada-type exceptions and simplified tasking to your C programs. Implemented for lattice C 1.00 and 2.00, all four memory models. Small, efficient, OK to copy if not for resale. Documentation and package on diskette, \$5.95 postpaid. Plain Vanilla Corporation
P.O. Box 4493
San Diego, CA 92104

MODULA-2 SCREEN TOOLS

REPERTOIRE: a unique high-performance screen display system with source, plus a multi-window editor to include in your programs. \$64. Not a code generator. Full input checking, help, and branching logic. DMA video, string, list, and windowing tools. Logitech & ITC versions. FREE documentation on req.

PMI
4536 SE 50th
Portland, OR 97206 (503) 293-7706
MCI Mail: 269-1013; Compuserve: 74706.262

SOURCE CODE LIBRARY SYSTEM

TLIB™ stores ALL versions of your source in ONE compact library file, even with hundreds of revisions. Updates ("deltas") faster than many editors load & save files, 5-7 times faster than Unix SCCS. Date & comments for each version, easy retrieval. LAN-shared libraries with PC Network DOS 2.x/3.x \$99.95 \$3 s/h VISA/MC. Burton Systems Software
P.O. Box 4156
Cary, NC 27511-4156
(919) 469-3068

TURBO EXECUTIVE

For Real-Time Multi-tasking control applications. Interrupt driven, Turbo Pascal Source code includes a background ASYNC COM task, windowing, video and directory utilities! \$64.95. Call or write for FREE brochure. Consulting and programming services avail. Clear Creek Computing
2107 Audubon
League City, TX 77573
(713) 332-9940

MODULA 2 to dBASE.....\$94.50

Now the structural clarity and compiled efficiency of Logitech Modula 2 are available to users of dBASE3 files. ModBase is a complete interface including source, examples and utilities. ModBase with Logitech compiler \$175. Add \$5.00 shipping.
Fletcher Software
1742 Second Avenue, #275
New York, N.Y. 10128
(212) 289-0328

SOFTWARE/EDIT

ZED—THE EVERYTHING EDITOR

A Full-Screen Editor with four-way cursor control. Disk repair, binary file edit, hidden file edit. Create your own copy protection, modify existing object modules quickly and easily with ZED. Edit in Hex or Text or BOTH. Search for Hex or ASCII strings. On-line HELP screen. \$39.95 +\$1.60 (tax in GA)+\$2 shipping.

Dickens Data Systems
6065 Atlantic Blvd.
Norcross, GA 30071
(404) 448-6177

SED-SCREEN EDITOR

Versatile full screen editor loads ANY file. Write programs, design screens, fix non-text files, edit anything! Has key macros, search/replace, block print, undelete, scroll up/dn, much more. Runs on compatibles. Written in C. Not copy protected. Site licensing available. Only \$19 + \$2 shipping. Call for our flyer.
DISC (Data Integration Services Corporation)
1725 K Street, N.W., Suite 611
Washington, DC 20006
(202) 785-8585

Lil'JAKE

"The WORLD'S GREATEST Editor." That's what our users say about Lil'JAKE.

*Edit multiple files
*DOS commands

*Comprehensive (terse/verbose) online help
*Programming support BASIC, DOS & BIOS

*MACRO facility
We're so sure you'll like it, we want to send you a copy for a free 60-day evaluation. \$49.95 + s/h To order: Write or CALL NOW!
Fooks Mathewson Company
P.O. Box 2424 (Open-28)
Arlington, VA 22202
(703) 684-8284

SOFTWARE/ENGINEERING

smARTWORK®

Printed-circuit artwork editor for double-sided boards up to 10" by 16", runs on an IBM-PC. Color display allows complete interactive control over the placement and routing process. 2X artwork can be made on a dot-matrix printer or pen-and-ink plotter, \$895. Write or call for a brochure.



WINTEK

WINTEK Corporation
1801 South Street
Lafayette, IN 47904-2993
(317) 742-8428

METAL FABRICATORS

PC/Cutlist takes input from your bill of material—Detail drawing and calculates the best cutting combination for any length stock and prints a shop ready cutting list and scrap report. Also an optimization feature finds best mult length for mill orders. Price \$300. Demo Disk \$25.00
THE JOSEPH ALBERT CO.
P.O. Box 611
Blue Island, Illinois 60406
(312) 349-9032

TECH BOOK

PC/8087 ARRAY PROCESSING

The VECTOR87 library is written in assembler, includes 60 subroutines to speed scientific programs by 2 to 18x. FFT, vector operations, convolution, etc. 1K real FFT takes 1.2 second. Also Fortran 2D FFT, linear equation solvers. Versions for Lattice C, MS C, IBM Pro Fortran, MS Fortran. \$120 each w/source. Check/P.O./VISA. VECTORPLEX Data Systems Ltd. P.O. Box 138 Station M Calgary, Alberta, Canada T2P 2H6 (403) 248-1250

CREATE PCB's EASILY

Easily create double-sided printed circuit board artwork of up to 21" square using PC-Layout on an IBM-PC. The artwork is created using a color artwork editor. The final artwork, solder mask and silk-screen (text) is produced using either a printer or a plotter. Price \$745. Demo disk/manual \$45. Demo disk created to final purchase.

Draco Technology
7210 Jordan Ave., Suite D50
Canoga Park, CA 91303
(800) 235-6646 ext. 646 (outside CA)
(800) 235-6647 ext. 646 (CA only)

SOFTWARE/GENERAL

PUBLIC DOMAIN SOFTWARE IN C

Over 60 volumes of public domain software in CP/M & MS-DOS formats.

- editors & compilers
- text formatters
- communications packages
- many UNIX-like tools

Write or call for more details.



THE C USERS' GROUP
P.O. Box 97
McPherson, KS 67460
(316) 241-1065

SOFTWARE/GRAPHICS

TEKTRONIX 4010 EMULATION

High resolution screen/printer graphics for the IBM PC. Full interactive capabilities with file transfer and cross-hair control. Utilizes PLOT 10, protocols. OFF-line review of graphics output. Supports IBM color/graphic or Hercules cards. Easy to use 4010 emulation at an affordable price. \$80.00. Demo disk \$5.

Technological Systems Group
5044 Haley Court
Lilburn, GA 30247
(404) 923-4980

FOR PRO & NOVICE ALIKE

BOARDS: Tecmar, Hercules, IBM E/CGA, AT&T. LANGUAGES: DeSmet-C, C86, Lattice-C, MS-C, Turbo Pascal, MS-Pascal, MS-Fortran, MS-Macro86. PRINTERS: Epson, Okidata, Toshiba. FAST: 200K pixels/sec avg. TIGHT: 10K. COMPLETE: 2/3D-Lines, Bit Blks, Windows, Color, Fill, Arc, Icon, Zoom, Trig, Character, String, Mouse, Keyboard, Timers, Menu Grids, & more. PLUS: Icon Editor, Fonts. No royalties! MODULES: \$35.



AFFINITY, INC.
126 Normal Ave.
Buffalo, New York 14213
(716) 882-5077

GRAPHICS LIB FOR TECMAR

TEK-MAR lets you do high-res graphics on your TECMAR Graphics Master. TEK-MAR is a library for use with MS Fortran. Features windowing, viewporting, clipping, axis rotation. Similar to Tektronix graphics. Includes screen dump/restore, Epson screen print, support for Hewlett Packard, Western Graphite plotter. Requires MS-FORT 3.20, 320K, GMDEV.SYS (5.2). Price: \$195.

ADVANCED SYSTEMS CONSULTANTS
21115 Devonshire Street, Suite 329
Chatsworth, CA 91311
(818) 990-4942

SuperCAD a2.5D system.

Developed by a Columbia University graduate, it's very fast and powerful, supporting all the most advanced I/O devices and the 8087. It works like a screen oriented word processor for graphic primitives and drawings. Free 1 yr. update service available in the US. Send \$1500 by check, L/C or P/O. Dealers Welcome!

CAD-CAM-II SRL
Via Fornaci 1
06034 Foligno ITALY
Tel: (0742) 20921

PLOTTER SOFTWARE

Presentation aides (word charts) are quick and easy to prepare using the DGI SIGNMAKER. With the DGI SIGNMAKER, your PC and plotter (IBM, HP, HI, Epson) your overheads, text slides or signs will have that professional look. \$75. For additional information, ordering or to check compatibility contact:

Decision Graphics, Inc.
P.O. Box 2776
Littleton, CO 80161
303-796-0341

DIGITIZER SOFTWARE!

Make the most of your digitizer with Easy Digit software. Many features capture and manipulate x-y coordinates, areas, distances, etc. from graphic images on any type of document. Use output files with spreadsheets, databases or your own programs. \$495. Call today for advice on your application.

OMNITECH, INC.
50 Baltusrol Way
Short Hills, NJ 07078
(201) 376-6406

FORTRAN GRAPHICS LIBRARY

MicroGlyp/Sciplot library provides IBM pro pr MS 3.2 FORTRAN graphics routines for high resolution IBM or Epson printers, color cards on IBM PC/XT/AT (PC DOS). Full plotting package 14 fonts, clipping, rotation, lin/log axes, multi-frame with (240 x 216) resolution. Price: \$59.95 + \$3 shipping + MA tax. MicroGlyp Systems P.O. Box 1066 East Arlington, MA 02174

GRAF 3.0 PRINTER GRAPHICS

Create bar, pie, scatter, and line graphs on your Epson, C Itoh, or IBM graphics printer. Supports 14 fill-in patterns, 8 plotting symbols, auto scaling, legend creation. Can read floating point data in a wide variety of formats. Requires DOS 2 or 3, 192K. \$69.95—includes USA shipping. No credit cards.

MicroComputer Systems Consultants
27-P Forest Avenue
Port Jefferson Station, NY 11776
(516) 928-7493

MetaWINDOW™

Advanced graphics toolkit provides Xerox Star/Apple Macintosh style graphics on your IBM PC. Supports most popular graphics cards. Allows you to create pop-up menus, windows & icons; use proportionally spaced fonts; rubberband & drag lines, text or bitmap images; supports mouse-cursor tracking. Tightly optimized for use with Turbo Pascal, IBM Pascal, C, Fortran & Compiled Basic.

METAGRAPHICS SOFTWARE CORP.
4574 Scotts Valley Drive
Scotts Valley, CA 95066
(408) 438-5352

SOFTWARE/LANGUAGES

EASY WAY TO MASTER DOS!

New handbook shows how, why, and when to use all 44 PC & MS DOS commands quickly and easily! Lively hands-on tutorial makes learning fun, for a change. Covers basic thru advanced topics. All versions up to 3.1. Lots of practical examples. 221 pages only \$15.95 at bookstores, or send check + \$1.00 S&H to:

LITTLE, BROWN & COMPANY PUBLISHERS
200 West Street, Code T-368121
Waltham, MA 02254

1-800-343-9204 (credit cards)

muLISP-85™ RELEASED

muLISP-85 is an integrated AI programming environment that includes over 350 Common LISP functions, a high performance compiler and interpreter, a window-oriented source file editor and debugger, an on-line tutorial system, and a detailed reference manual. Write or call for more detailed information.

SOFT WAREHOUSE, INC.
3615 Harding Avenue, Suite 505
Honolulu, HI 96816
(808) 734-5801

SOFTWARE/OPERATING SYSTEMS

pcSHARE MULTI-USER O/S

pcSHARE allows your IBM-XT or compatible to support up to 4 users running 123, dBASE, WordStar, etc on inexpensive serial CRTs. For the software developer, pcSHARE efficiently runs compiled Basic, Pascal & C programs with full DOS 3.0 record locking. No risk 30 day money back guarantee.

DIGITROL COMPUTERS, INC.
440 Phillip Street
Waterloo, Ontario, Canada N2L 5R9
(519) 884-4541

UN/EMULATOR BY WAWA

Run CPM on your PC or clone at MACHINE SPEED. UN/EMULATOR runs native 8080 code and increases DOS performance by 10%. We include disk conversion software, terminal emulators, and serial transfer utility. Available in 5 MHz and 8 MHz. Starting at \$99.95 plus \$5 S&H. Dealer inquiries welcome. Call or write:
WEITZMAN AND WOOD ASSOCIATES
580 N.W. 99th Way
Pembroke Pines, FL 33024
(305) 432-8025

CX/PC EXECUTIVE V2.0

Real-time, priority task scheduler. Functions to queue inter-task messages and pointers. Example tasks. Interrupt-driven timer, serial and parallel port interfaces. Runnable demonstration programs. DeSmet C source included; no license for generated programs. Described in June '84 IEEE Micro article. \$75. Brochure.

INTR-SOFT CO.
P.O. Box 351
Bedford, MA 01730
(617) 369-6242

SOFTWARE/SCIENTIFIC

MATRIX/CALCULATOR

Stand-alone programmable calculator with 70+ matrix operations, statistics, system of lin. & nonlinear & diff. eqn's, numerical integral & 1-dim optimization. User programmable func. \$49.95 includes S&H, 100+ pg manual, lyr, tech support. 8087 version same price. VISA, MC accepted. For INFO: (313) 534-4933

SoftTech Inc.
18505 W. 8 mile, Suite 104
Detroit, MI 48219
Orders: 1-800-835-2446 ext. 80

TECH BOOK

SOFTWARE/SECURITY

SECURE AT/XT/PC

Control system access, data access! FIXT/S. Control system boot for most popular XT/PC hard disk controllers. Feature for AT-and-XT-compatible HD controllers segments hard disk by volumes, controls access with passwords, supports hard disk expansion. \$70-\$130 + \$3 shpg. plus CA tax.



Golden Bow Systems
P.O. Box 3039
San Diego, CA 92103
(619) 298-9349

SOFTWARE/SERVICES

DATA CONVERSION ON PREMISES

Keep your data confidential. To/FROM cards, disks, tapes. ASCII/EBCDIC, 800/1600/3200BPI 9-Track. For IBM-PC/XT/AT and the compatibles. Hard disk and Bernoulli Box owners, we will bring our systems and do the conversion on your premises.

DP Modern Systems
804 North Reeder Avenue
Covina, CA 91724
(818) 966-2628

SOFTWARE/STATISTICS

RATS!

RATS is the ultimate econometric software package. It is powerful, fast, accurate, and inexpensive. RATS performs regression analysis, time-series forecasting (including Box-Jenkins) and cross-section (including logit and probit). RATS supports a variety of data formats, including Lotus WKS files. RATS also offers a programming language that provides maximum flexibility and power. Spectral analysis and graphics are available as options. Base program \$200. Demo including 300 page manual \$40. MC/VISA.

VAR Econometrics
P.O. Box 19334
Minneapolis, MN 55419
(612) 822-9690

ELF—THE STATISTICAL PKG.

Interface with Dbase and Lotus files or will create its own. Factor analysis, stepwise regression, discriminant analysis, 1&2 way anova crosstabs, correlations, t-test, frequencies, transformations...unlimited observations, 500 variables in database. All new and improved manual, 30-day examination. Call for more. The Winchendon Group, Inc.

P.O. Box 10339
Alexandria, VA 22310
(703) 960-2587

SOFTWARE/TERMINAL EMULATION

VT-102 & 4010 EMULATION

PC 102 turns an IBM PC/XT/AT/jr to a VT-102/100/52 terminal with printer/file transfer support. Optional: 132 col., 4010 graphics support. Guaranteed compatibility with all VT-100/52 applications including EDT, WORD II, All-In-One, & UNIX. Easy to use. 3000+ sold. From \$89. MC/VISA/COD. Call for free package! Moneyback guarantee.

General Micro Systems
P.O. Box 5330
Hopkins, MN 55343
(612) 944-0593

SOFTWARE/UTILITIES

AT/XT/PC HARD DISK EXPANSION

Replace hard disk with a bigger one, or add a second drive! Feature supports high capacity drives on standard AT, XT, and compatible hard disk controllers. Includes multiple volumes, security features, selectable clusters, keyboard lock. \$80-\$120 + \$3 shipping + CA tax.



GOLDEN BOW SYSTEMS
P.O. BOX 3039
SAN DIEGO, CA 92103
(619) 298-9349

DISPLAY ANY MS-DOS FILE

List ASCII and binary files. TRUE/View can be invoked as a pop-up or directly from DOS. Switch between ASCII and hex modes. View multiple files. Search for string patterns. Mark file positions for easy retrieval. Make small changes with edit feature. User configurable. \$19.95

GRW Software
P.O. Box 440007
Houston, Texas 77244
(713) 556-9878

TRUE PATH UTILITY

Never misplace files again. TRUE/Path extends the MS-DOS PATH utility to search for data files as well as programs. Unlike other path programs, TRUE/Path uses the same path given by the MS-DOS PATH command to locate data files. Works with all MS-DOS software. A perfect for inexperienced users. \$19.95

GRW Software
P.O. Box 440007
Houston, Texas 77244
(713) 556-9878

DBASE

GRW Software
P.O. Box 440007
Houston, Texas 77244
(713) 556-9878

EASY AIM-30 day trial

Installs your programs on a hard disk and creates subdirectories, paths, and displays programs in a menu, all automatically. Features include time log, backup to floppy or tape, copy files to/from floppies to/from/between menu selected directories. DOS is transparent to end user. Powerful yet simple. \$84.95.

LARSON SYSTEMS, INC.
BOX 193
STORY CITY, IOWA 50248
(515) 733-2717

DISK MECHANIC

THE ULTIMATE Floppy Disk Backup & Repair Utility. Can back up ALL software protected disks written on the IBM PC. Works manually or automatically. Files or sectors can be restored, searched, examined & changed. Checks disk drive speed, req. IBM PC, XT, AT, DOS 1, 2, 3, 192K + 64K if only 1 floppy drive. \$73 ppd. USA MLI MICROSYSTEMS
PO BOX 825, Dept TB2
Framingham, MA 01701 USA
(617) 926-2055 for info MC/VISA

CHARACTER CUSTOMIZATION

CHARGENI works with the IBM EGA to let you modify the character set, allowing many word processors to display technical material, equations or other special characters. Also works on the Color/Graphics Adapter in graphics modes. Requires DOS 2.x or 3.x, IBM Standard or Enhanced Graphics Adapter. \$25 + \$2 s/h (MN add 6%).

DK Micro Consultants
P.O. Box 6714
Minneapolis, MN 55406
(612) 722-0931

HARD DISK DIRECT ACCESS™ 4.0

The Ultimate Hard Disk Menu System. Organizes your software programs into a "user defined" menu system. Features single key stroke access, time usage tracking, custom applications, plus much more. Order toll free today. 30 day money back guarantee.



Delta Technology International Inc.
P.O. Box 1104
Eva Claire, WI 54702
To order: 1-800-242-MENU
For more info.: 715-832-0958

dBASE II AND dBASE III

CHECK corrects nesting and locates errors in dBASE command files. Custom configuration for all default values. Accepts dWINDOW and Clipper commands. \$49.00. REPAIR recovers data from corrupted databases by resetting the record counter, offsetting if required, and relocating the EOF marker. \$29.00.

HILCO SOFTWARE
304 North 17th Street
Mount Vernon, WA 98273
(206) 428-0475

VM/CMS FLIST FOR IBM-XT

Full function DOS hard-disk shell. Functions like VM-ISPF mainframe mini-disk manager. Functions include definable function keys, directory sorting, online help feature, can execute PC-DOS commands & user programs from shell, and changeable screen colors. Have mainframe power on your IBM-XT. Only \$50.

JASPER SOFTWARE
6102 Mockingbird Lane, Suite 221
Dallas, Texas 75214

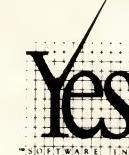
FSD: FULL SCREEN DOS.V2

Full Screen DIR list(s). Multi-1 key commands. Sort 8+ ways, split-screen & resident/loaded modes. Copy/Move with Replace/NoReplace. User defined F-Keys. Interactive BAT files. Log PC usage. +Other features. Docs on disk. PC/XT/AT etc. w/128K, DOS 2.0+. \$49.95 w/hard-copy docs. \$29.95 w/disk docs. +\$5 for Non-DSDD specify.

TORTUS SOFTWARE
14051 Lambeth
Tustin, CA 92680

RE/CALL™

The best macro-processor for PCs. Make pop-up menus to list/control macros inside any program. Unique and essential correct and step mode—like 123. Only editor that never truncates macros or becomes unavailable. "Slick. Enticing features"—Pop Cmplx. "Unique step mode"—Tech Journal. "Natural and intuitive"—PC Products. ... deserves a home in every PC"—PC Week. US \$89.95. 30 day money back guarantee. VISA/MC/COD.



YES SOFTWARE INC.
390-10991 Shellbridge Way
Richmond, BC, Canada V6X 3C6
(604) 270-4152

COMPARE ASCII FILES

Is the COMP command in DOS what you expected? No? That's what we thought. Our little program CAF is a very smart utility similar to the ones in mainframes. CAF compares two ASCII files and produces a no-nonsense differences report. A must for all PC programmers & users. Only \$12.95 + \$3 s/h (Calif. + Tax). Send check or money order to:

I.S.E. Inc.
P.O. Box 241740
Los Angeles, CA 90024
(213) 398-3106

TECH BOOK

LASERDRIVE

A path to your laser printer! Loadable device driver transmits any file to laser printers via RS232. Background to foreground. Uses Xon/Xoff protocol. Also ASCII file listings, line printer emulation. Use Apple LaserWriter, Imagen, QMS, HP LaserJet Plus, Postscript, etc. MS DOS 2.1/ later. \$49.95
TEXTSET, Inc.
P.O. Box 7993
Ann Arbor, MI 48107-7993
(313) 996-3566

THE NIBBLER 2.0

Provides ultimate DATA INTEGRITY for DOS systems. Powerful, easy and up to 10X FASTER than NORTON! 2-key UNERASE. Edit-View sectors encrypt, wipe or copy files. SEARCH memory, files or disks. View and edit 1MEG of memory. Supports IBM-AT, FIXED, and RAM disks. DOS 2.x+\$49.95+\$2.50 S&H. CA 6% CHK-MC DEALERS WELCOME!
TACHYON SYSTEMS INC.
2725 Congress St. Suite 2H
San Diego, CA 92110
(619) 574-1666

POP-UP SHOWFILE UTILITY & POP-UP DIRECTORY SUPPORT

DK SHOWFILE is a RAM-resident or DOS loadable utility for displaying all types of DOS files, Anytime. Variable view window, string search, help key, ASCII/HEX/EBCDIC display modes & more. Instant recall feature keeps a file & view window only a keystroke away—great for debugging! \$29.95
DK DIRECT, also RAM-resident, brings DOS subdirectory support to most programs. \$24.95.
DK Softworks
P.O. Box 201182
Austin, TX 78720
(512) 345-3684

PreCursor

Makes the hard disk easy. Create menu pages containing applications, BASIC programs, batch files or DOS commands with ease. Then let PreCursor automatically search for the directory and path, showing you all occurrences of a program on your hard disk; no manual input required. Includes on-line help, triple level passwording, even screen color options. 30-day Moneyback Guarantee \$69.00 plus \$5 s&h. VISA/MC.

PreCursor

David L. Aldridge Co., Inc.
340 Town & Country Village
Houston, TX 77024
(713) 464-7465

BACKBONE

Give a PC/XT/AT BACKBONE! Customize sets of linked menus with a Menu Processor (tm). Then access any program, batch file, or submenu with a keystroke. Adds POWER, STRUCTURE, and SIMPLICITY to any system. The IDEAL hard disk organizer. Supports multiple users. Compact, Fast, Guaranteed, and Well-Supported. \$39.95 +\$4 s/h. MC/VISA.
SYNCHRONY SYSTEMS
4191 San Juan Ave.
Jacksonville, FL 32210
ORDERS: (800) 237-6360 ext. 314
(800) 282-1152 ext. 314 FLA

TurboRef

Pascal, programmers get organized with TurboRef! TurboRef will cross reference a source program and create a program listing. TurboRef can process a list of files, will read "include" files, identifies line number for each reference. Source code included, IBM PC, XT, AT or compatible, only \$49.95, VISA, MC or check.

G RACON SERVICES, INC.

Gracon Services, Inc.
4632 Okemos Rd.
Okemos, MI 48864
(517) 349-4900

RAMbak \$9.95

Never lose RAM disk files again. RAMbak automates the saving of new or changed RAM disk files to floppy disks and/or hard disk subdirectories. RAMbak saves time, gives peace of mind. A new utility RAM disk users shouldn't be without. PC, XT, AT compatibles with 128K, DOS 2.0+. Only \$9.95 MN res. +6%

Software Brewing Company

Software Brewing Company
P.O. Box 12094
St. Paul, MN 55122
(612) 636-2727

Directory Extended

THE MOST POWERFUL directory display and file management tool! Multiple in- and exclusion patterns; multiple wildcards. Generate batch files; file search; flexible sorting; list directories; transfer test; date/time/size ranges; delete or checksum files; set any attributes; MUCH MORE. Send \$25 + \$5 p&h-money back guar. (in TX w/tax \$31.84) to:
Robert K. Blaine/ECONO-SOFT Dept T63
9200 North Plaza #1906
Austin, TX 78753

NEW ... TURBO PACKAGE

- Break the 64K Turbo Pascal barrier. You may never need to convert to MODULA 2.
- Load 500K of resident Turbo Pascal code and call it from a Turbo Pascal program. This pre-compiler makes Turbo Pascal short calls into long calls. It is a thousand times faster than chaining or overlaying.
- Turbo Package will be available for \$39.95 Turbo Package documentation for \$5.00. The first 100 respondents who send their name, address, phone number, and \$5.00 will also get a free preview diskette with all the Turbo Package software.

CONVERSATIONAL COMPUTER SYSTEMS
5371 VERBENA RD.
SAN ANTONIO, TX 78240

C + ASM + dBASE = dLINK

Finally! with the dLINK system, any number of Lattice C and MASM functions can be called directly from dBASE II, using natural c syntax to pass arguments (incl. pointers, constants, all types of variables) Complete system is elegant, lightning fast, and flexible. Req. 256K, dBASE II v2.4+, DOS 2.0+ \$69 ppd.
St. Elias Software
4012 Ashworth Avenue North
Seattle, WA 98103
(206) 632-4049

SOFTWARE/WORD PROCESSING

FORMAT™ TEXT-FORMATTER

For technical texts. Sizes & places equations, matrices, ratios, integrals, big symbols, footnotes. Macros, multiple fonts, 158 Greek/math symbols. Automatic hyphenation, section/equation/reference numbering, indexes, table of contents. Dot-matrix, daisywheel, laser printers, plain/graphics monitors. \$400. \$50 for demo.

$$\lim_{n \rightarrow \infty} \sum_{j=1}^n \left[\frac{1}{x(j+1)} - \frac{1}{x'} \right] = \frac{1}{2} \left[\int_{x'}^{\infty} \frac{\ln(1-x)}{x^2} dx \right]^{-1}$$

SHANHA SOFTWARE, INC.
50 West 97th St. Room 11N
New York City 10025
212-222-7647
Touch-tone Toll-free: 950-1088-wait-FORMAT

REPRINTS AVAILABLE

Quantity reprints of articles appearing in PC Tech Journal are available and will be prepared to meet any special requirements. Inquiries should be directed to Eileen Pfeiffer, Reprints Dept., Ziff-Davis Publishing Co., 1 Park Ave., New York, New York 10016. Phone 212-503-5447.

TECH JOURNAL

TECH MART

64K ■ 128K ■ 256K

DRAMs

80287-8 ■ 80287-3

8087-3 ■ 8087-2

8087-1

BITTNER



ELECTRONICS

899 SOUTH COAST HIGHWAY
LAGUNA BEACH, CA 92651
(714) 497-6200

CALL NOW FOR **FREE** CATALOG

CIRCLE 385 ON READER SERVICE CARD

**FORTRAN
or
PASCAL
PROGRAMMER?**

READ
THIS
AD



GRAPHICS

- Text/graphics generics
- 2D interactive
- 2D plots (full support) including auto-scaling, auto-axis generation, auto-labeling, tabular/log/parametric curves, splines, bars, pies, you name it, we have it.
- 3D Plots incl. 2 hidden line removal options—not just old-fashioned wire frame.

PEN PLOTS

- Standard plotter primitives plus
- FULL 2D support plus
- Interface to screen graphics,
- Limited 3D.

Clear and complete documentation.

GRAFMATIC \$135.

PLOTMATIC 135.

MICROCOMPATIBLES

301 Prelude Drive
Silver Spring, MD 20901
(301) 593-0683

CIRCLE 400 ON READER SERVICE CARD

Learn the C Language Interactively

Step-by-Step With *Introducing C*

Introducing C is a powerful C language training system that combines a thorough, self-paced manual with a unique C INTERPRETER to provide a fast efficient method of learning C.

A COMPREHENSIVE APPROACH

Introducing C covers all the essential elements of C. The interpreter utilizes standard K&R syntax and operators - full structures and unions, arrays, pointer and data types. It provides the standard I/O library and an extended graphics library.

The package has many user oriented features including a screen text editor and extensive error diagnostics (includes dynamic trace capabilities).

INTRODUCE YOURSELF. TODAY

Introducing C is available for immediate delivery. System requirements are IBM PC, XT or AT with one disk drive and 192K bytes of memory. Priced \$125.00. Not copy protected.

TO ORDER CALL 800-922-0169

**COMPUTER
INNOVATIONS, INC.**

980 Shrewsbury Ave., Tinton Falls, NJ 07724 • (201) 542-5920

CIRCLE 381 ON READER SERVICE CARD

Create your own
unique PC interfaces
in minutes!



The PD100 allows rapid development of specialized PC interfaces. It features a buffered data bus, switch-selectable address decoder, and a large prototype area (up to 40 IC sockets). The 116-page manual covers basic interfacing concepts and details implementing A/D, D/A converters, I/O ports, connection of transducers and dozens of useful circuits.

PD100 w/manual - \$99
plus \$3.50 P&H
Manual only - \$20 Postpaid
PA residents add 6%
Check, MasterCard, or VISA (814) 234-8087

REAL TIME DEVICES

1930 Park Forest Ave.

P.O. Box 906

State College, PA 16804

TERMINAL EMULATION

Softerm PC emulates over 30 popular terminals including the:

- DEC VT102, VT220
- Data General D200, D410
- IBM 3101-20 (block mode)
- Hewlett-Packard 2622A
- Honeywell VIP7801, VIP7803

Guaranteed Compatibility

Call for free product brief

\$195 MC-VISA-COD

For the IBM PC/XT/AT, DG1, NEC, Wang PC, TI Pro, Gridcase, Tandy

SFTRONICS

7899 Lexington Dr., Ste 210
Colorado Springs, CO 80918
(303) 593-9540

CIRCLE 391 ON READER SERVICE CARD

PERFECT COPIES GUARANTEED

Why risk duplicating your important programs on your computer, when our equipment is designed solely to duplicate disks and verify their perfection 100%?

Over 600 formats. 3½", 5¼" and 8". Plus serialization, copy protection, labeling, packaging, shrink-wrapping and fast, personalized service.

**Western
Transdata Inc.**
DISK DUPLICATION

1701 E. Edinger Ave.
Building A4
Santa Ana, California 92705
(714) 547-3383 (Collect)

CIRCLE 396 ON READER SERVICE CARD

FANSI- CONSOLE™

The Integrated Console Utility™

All the little things IBM forgot!

for IBM-PC, XT, AT & clones.

- 1.2 to 3.0 times faster DOS & BIOS screen writing
- more escape sequences than ANSI.SYS
- usable in any language
- scroll recall facility
- compatibility w/PC & AT software
- full EGA support
- 255 character typeahead buffer
- increase key repeat rate
- no scroll blink for some adaptors
- VT 100/52 emulation
- auto dual screen disable
- keyboard induced breakpoints
- window support
- support for 50 line display
- many many more little features

Shareware disk \$25 or

400p Manual (w/slot case) & disk \$75

As described in Lotus June 85 pg. 8

HERSEY MICRO CONSULTING, INC.
Box 8276E, Ann Arbor, MI 48107
(313) 994-3259 x363 VISA/MC

CIRCLE 386 ON READER SERVICE CARD

Vscreen For Turbo Pascal

Vscreen - a professional virtual screen management system.

- For Turbo Pascal 3.0+ , PC's and real compatibles.
- FAST - Direct video manipulation in assembly language.
- 255 Virtual screens, up to 64k per screen.
- Windows can drag, resize, pop up, slideout, explode...
- Scroll horizontally and vertically.
- Fully automatic window overlap control.
- Formatted I/O-atsay, atget with full validation.
- Compatible with standard Turbo screen syntax.
- Mono or color-no snow, no flicker, "instant" updates.
- Flexible frame and title control.
- Mouse ready.
- Most sophisticated routine for the PC color card.
- Advanced Numeric and string formatting.
- Insert or delete lines, characters, line wrap/no wrap, recolor/highlight areas, cursor control.

Why compile hundreds or thousands of lines of Pascal source each time for a feeble, slow running windowing package when you can have a full virtual screen management system written in assembly language?

Pascal source and assembly ".com" file: \$59.95
With 100k of assembly language source: \$99.95

Northport Software
1817 Domaniuk Dr., fg
Racine WI 53404
For orders call:
414-637-5740
WI residents add 5% sales tax

Turbo Pascal is the trademark of Borland International

CIRCLE 380 ON READER SERVICE CARD

TECH MART



AUTOMATIC BACK-UP

Automatic backup of information
for PC's with hard disk drives



Please ship me the following:

- ENSURE \$79.95
- ENSURE with 20 Meg. \$119.00
- ENSURE with 2/20 Meg. \$149.95
- Clock \$69.95
- Controllers & Cables \$149.95

Plus \$4.75 for shipping and postage

PRICE BREAK ON 5 OR MORE QUANTITIES

Add 5% for Bankcards

(No COD's or personal checks.)

Money orders or certified checks accepted.

Mail ALL orders to.....

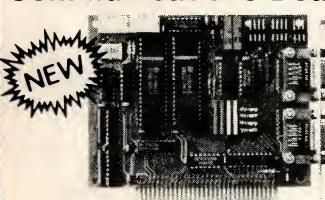
CREATIVE LOGIC®

8240 Indy Lane, Indianapolis, IN 46224
317-271-1100

CIRCLE 388 ON READER SERVICE CARD

RS-422

Communications Board



- For IBM-PC/AT/XT and compatibles
- Dual RS-422 serial interface
- Programmable to 56k baud
- Differential drivers to 4000 ft.

\$345.00



QUA TECH, INC.

478 E. Exchange St. Akron OH 44304
(216) 434-3154 TLX: 5101012726

CIRCLE 384 ON READER SERVICE CARD

BULK DISKETTES

BY

NASHUA

75¢
each
Qty. 100

5 1/4" DS/DD with hub ring and Tyvek sleeve, bulk packaged, no labels, factory warrantied. Shipping extra. For quantity 50, add 10¢ each.

Get the same low price our high-volume duplication customers get!

CALL TOLL FREE

1-800-321-4668

in Colorado, 303-234-0871

VISA, MASTERCARD, OR COD ACCEPTED

ALF 1315-F Nelson St.
Denver, CO 80215

YOUR BACK-UP SYSTEM FOR ADVANCED PC INFORMATION

As an IBM PC expert,
you're the source of
information on IBM PCs.

But when you need
answers, where do you turn?

TURN TO PC TECH
JOURNAL—you can depend
on it every month for the
most authoritative coverage
of innovative applications,
systems design, and technical information.

Save 50% off the single copy price of \$47.40.
One year (12 issues) only \$23.70.

Use the coupon below, or call

1-800-852-5200

toll-free

**TECH
PC
JOURNAL**

P.O. Box 2966, Boulder, CO 80322

4Z320

YES! I want to subscribe to PC TECH
JOURNAL for one year (12 issues)
for only \$23.70—half off the
one-year single copy price.

Mr./Mrs./Ms. _____

Company _____ Title _____

Address _____

City _____

State _____ Zip _____

Savings based on full one-year (12 issues) single copy price of \$47.40.

Check one: Payment enclosed Bill me later

Charge my: American Express Visa MasterCard

Card No. _____ Exp. Date _____

Please allow 30 to 60 days for delivery of first issue.

VTEK™ 3.1

VT100/VT52 & Tektronix™ 4010/4014 Terminal Emulator

Excellent emulation and the features you want:

- use 4096 x 3120 resolution
- zoom, pan, and window plots
- high resolution printer dumps
- choose text and plot color
- transfer files with XMODEM and Kermit protocols
- scroll last 4 pages of text
- 132 column VT100 capability
- 19 User-definable keys
- capture plots and text on disk
- full or half duplex
- access to DOS commands
- all VT100 keypad commands
- command line editing
- fast direct screen access
- password security

VTEK makes your PC better than a terminal

\$150 from Scientific Endeavors

**Graphic™ 3.0
in Color**

Publication Quality Graphics for Scientific and Technical Applications

- linear, log, & polar plots
- bar charts & Smith charts
- contour plots with labels
- 3-D curves, 3-D surfaces with hidden line removal
- 4 curve types, 8 markers
- 14 fonts, font editor
- multiple levels of superscripts
- 4096 x 3120 resolution
- zoom, pan, window plots
- multiple plots on page
- high resolution printer dumps, full or half page
- plotter support in COLOR

16 color plots on EGA, Sigma, TeleVideo & Tecmar boards
Over 100 routines can be called by your C program. \$350. Demo \$8.

SOURCE INCLUDED for private use only.

For DeSmet, C-86, Aztec, Lattice, and Microsoft C compilers.

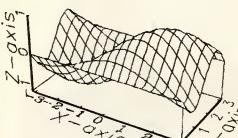
Scientific Endeavors

Route 4, Box 79; Kingston, TN 37763

(615) 376-4146

For 256k IBM and Corona PCs, DOS 2.xx, 3.xx, Epson, Okidata, Toshiba, C. Itoh printers. Hewlett Packard, Houston, Sweet-P plotters. Corona Laser printer. IBM, IBM EGA, Sigma, TeleVideo, Tecmar, Hercules, Corona graphics. A compatible assembler is required.

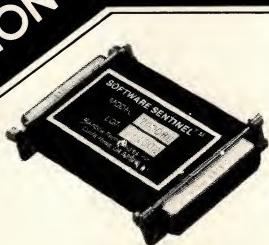
THIS AD WAS MADE USING Graphic™



CIRCLE NO. 187 ON READER SERVICE CARD

SOFTWARE SENTINEL™

MUCH
MORE THAN
JUST PROTECTION



Because its original objective was to protect software from unauthorized use, it's called the SOFTWARE SENTINEL. But maybe we'll change the name to REVENUE GENERATOR, since we've discovered its true value to our customers. But whatever we call it, everyone ends up with numerous benefits from this hardware key with unlimited "locks".

SOFTWARE DEVELOPER (PC, XT, AT)

- Prohibits unauthorized use of software
- No need for copy protection
- Easily controlled site licensing
- Unbreakable protection
- Lower cost of distributing updates
- Longer product/revenue life cycle
- Trial usage/rental of software programs

USER (PC, XT, AT)

- Unlimited backup copies
- No floppy required with hard disk
- Transportable
- Pocketsize
- Transparent
- Data security

EVALUATION KIT AVAILABLE



RAINBOW
TECHNOLOGIES, INC.

17971 SKYSPARK CIRCLE SUITE, IRVINE, CA 92714 (714)261-0228 Ext 200
Telex 386-078 Answer Back—RAINBOW TECH

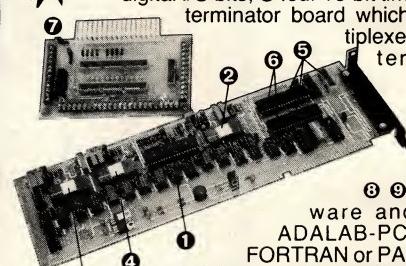
CIRCLE NO. 157 ON READER SERVICE CARD

ADALAB-PC™

Adds Lab Data Acquisition
To Your IBM® PC For \$595
An ideal interface for chromatography,
spectrophotometry, process control, etc.



NEW



ADALAB-PC includes ① a 13-bit integrating A/D, ② a 12-bit fast A/D (up to 20 kHz, add \$250), ③ a 12-bit D/A voltage output, ④ a second 12-bit D/A (add \$50), ⑤ 32 digital I/O bits, ⑥ four 16-bit timers or counters, and ⑦ a terminator board which has a 4-channel multiplexer and convenient screw terminals (16-channel differential analog multiplexer with programmable gains from 1 to 256, add \$300).

⑧ ⑨ Versatile ADAPT software and manual (free with ADALAB-PC) works with BASIC, FORTRAN or PASCAL, includes self-test and data acquisition software. Supports fast DMA sampling, extended memory storage, scrolling stripchart display.

⑩ LABTECH NOTEBOOK software \$895.

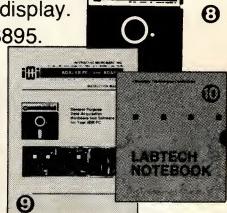
⑪ IMI is an IBM Value Added Dealer.

COMPLETE ADALAB-PC SYSTEMS

at \$3505, including 256K IBM PC,

360KB disk, PC DOS 3.0, green monitor,

color/graphics adapter, Epson printer with adapter & cable, ADALAB-PC, ADAPT software, plus IMI's Scientific Plotter-PC (\$95) and Curve Fitter-PC software (\$95) FREE with systems!



©Trademark of International Business Machines Corp.

iMi INTERACTIVE MICROWARE, INC.
P.O. Box 139, Dept. 237 Telex: 705250
State College, PA 16804 (814) 238-8294

CIRCLE NO. 209 ON READER SERVICE CARD

WIZARD C

Discover the powers of Wizard C
for yourself!

"...written by someone who has been in the business a while. This especially shows in the documentation."

Computer Language
February, 1985

"Wizard's got the highest marks for support."

"The Wizard compiler had excellent diagnostics; it would be easier writing portable code with it than with any other compiler we tested."

Dr. Dobb's Journal
August, 1985

Full Lint checking, six memory models, 8087 support, in-line assembly language, ROMable data support, full library source code. Cross-compilers are available on VAX/VMS and UNIX machines.

(617) 641-2379

Only \$450.

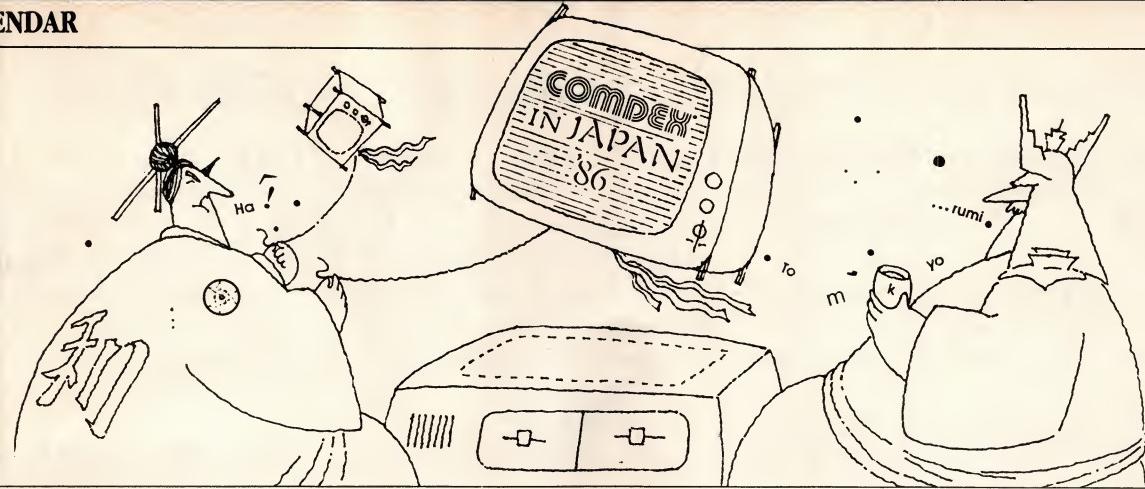


11 Willow Court
Arlington, MA 02174



CIRCLE NO. 221 ON READER SERVICE CARD

PC TECH JOURNAL

**MARCH**

March 2-4
Hard Copy Supplies Conference
Miami, FL
Contact: Jean O'Toole, C.A. Pesko Associates, Inc., One Snow Road, Marshfield, MA; 617/837-1341

March 3-5
Comdex in Japan
Tokyo, Japan
Contact: The Interface Group, Inc., 300 First Avenue, Needham, MA 02194; 617/449-6600

March 3-5
Relational Database Management Systems
Washington, DC
Sponsor: Digital Consulting Associates, Inc.
Contact: Software Institute of America, Inc., 8 Windsor Street, Andover, MA 01810; 617/470-3880

March 3-6
Compcon Spring '86
San Francisco, CA
Contact: Glen G. Langdon Jr., IBM, Department K54/282, 5600 Cottle Road, San Jose, CA 95193; 408/256-6454

March 3-6
First International Conference on CD ROM
Seattle, WA
Sponsor: Microsoft Corp.
Contact: Min S. Yee, Conference Chairman, Microsoft Corporation, 10700 Northup Way, Box 97200, Bellevue, WA 98009; 206/828-8080

March 9-12
Fourth Annual Computer Based Training Conference

San Diego, CA
Contact: Val Adell, Conference Registrar, Wein-garten Publications, Inc., 38 Chauncy Street, Boston, MA 02111; 617/542-0146

March 12
Physical Design Conference '86
Houston, TX
Sponsor: IEEE Technical Committee
Contact: Susie Whitesell, Tektronix, CAE Systems Division, 12303-A Technology Blvd., Austin, TX 78727; 512/331-1303

March 17-20
Symposium on Data Management Technologies
Los Angeles, CA
Contact: Digital Consulting Associates, 6 Windsor Street, Andover, MA 01810; 617/470-3880

March 18-20
VAR Congress '86
Dallas, TX
Sponsor: INFOMART
Contact: Nancy Keene, 1950 Stemmons Freeway, Dallas, TX 75027, 214/746-3500

March 19-20
IMPACT '86
Albuquerque, NM
Sponsor: Association for Information and Image Management
Contact: Susan Law, P.O. Box 27036, Albuquerque, NM 87125; 505/846-4042

March 19-22
Conference on Theoretical Aspects of Reasoning About Knowledge

Monterey, CA
Sponsor: American Association for Artificial Intelligence and IBM
Contact: Joe Halpern, IBM, K51/281, 5600 Cottle Road, San Jose, CA 95193; 408/256-4701

March 19-23
Third Annual Physicians and Computers: Applications in Patient Care
Las Vegas, NV
Contact: Beverly J. Johnson, University of Southern California School of Medicine 2025 Zonal Avenue KAM 318, Los Angeles, CA 90033; 213/224-7051

March 21
Buying and Selling Rights to Hardware, Software & Services
New York, NY
Contact: Data-Tech Institute, Lakeview Plaza, P.O. Box 2429, Clifton, NJ 07015; 201/478-5400

March 24-26
OAC '86: Office Automation Conference
Houston, TX
Contact: OAC '86, 1899 Preston White Drive, Reston, VA 22091; 800/OAC-1986

March 26-27
The Lotus Developer Conference
Cambridge, MA
Contact: Mark Scapicchio, Lotus Development Corporation, 55 Cambridge Pkwy., Cambridge, MA 02142; 617/577-8500

Cambridge, MA 02142;
617/577-8500

APRIL

April 1-4
First International Conference on Expert Database Systems
Charleston, SC

Sponsor: Institute of Information Management and American Association for Artificial Intelligence
Contact: Donald A. Marchand, Conference Chairman, Institute of Information Management, Technology, and Policy, University of South Carolina, Columbia, SC, 29208; 803/777-5766

April 3-6
West Coast Computer Faire
San Francisco, CA
Contact: Computer Faire, Inc., 181 Wells Avenue, Newton, MA, 02159; 617/965-8350

April 6-9
IEEE Symposium on Security and Privacy
Oakland, CA
Contact: Clark Weissman, General Chairman, SDC/A Burroughs Company, 2500 Colorado Avenue, Santa Monica, CA 90406

April 10-11
IEEE Infocom '86
Miami, FL
Contact: IEEE-CS, 1730 Massachusetts Avenue, NW, Washington, DC, 20036-1903; 202/371-0101

What you see is what you get . . . and send!

Transfer Protocol: Modem?/CRC Packet Size: 128 Files: 1

Block #	of	Kbytes	%	Time Remaining	Consec	Error File	Errors Total	Total Kbytes
31	522	3	5	5:06	0	0	0	3

Errors:

Status: Transfer in progress
[MEX File Transfer]



[CTL-C to abort]

Sending: >ANYFILE.AQC

Announcing Version 1.6 of **MEX**, the communications software with a view from the top. Regardless of your level of sophistication, **MEX** can put you on top of the data transfer game and keep you there. For the executive on the go, our new pull-down transfer screen and easy-to-use menus reduce the complexities of modem communications to a few keystrokes. For the advanced user, **MEX**'s greatly enhanced script processor offers a complete programming language for development of highly secure custom applications. If communication is money in your business, **MEX** may be the best investment you make this year.

Two options available:

MEX-PC is the most complete modem software you can buy. Allows you to switch between menu-driven and command-driven communications at will. Makes full use of Hayes AT command set, with overlays available for most other modems. Features include: complete script processor programming language; user-definable keystrings; auto-dial and auto-baud-set phone libraries; all popular protocols, including MODEM-7 batch transfers. \$59.95*

XMODEM CRC/XMODEM CHECKSUM/KERMIT/COMPUSERVE A/28 OR 1K BLOCKS
Versions available for IBM-PC and compatibles, Tandy 2000 and most CP/M machines.

MasterCard, VISA welcome

* plus shipping: Wisconsin residents add 5% sales tax.

MEX-PAC — All the features of **MEX-PC**, plus:

(1) A remote module that allows you to run your office computer from home, and vice versa; and
(2) Terminal emulation that lets your PC masquerade as a DEC VT52/100 or Televideo 925 terminal for on-line communication with mainframes. \$99.95*

Give us a toll-free call at
1-800-NITEOWL

In Wisconsin, 1-414-563-4013

Night Owl Software, Rt. 1 Box 7, Ft. Atkinson, WI 53538

CIRCLE NO. 243 ON READER SERVICE CARD

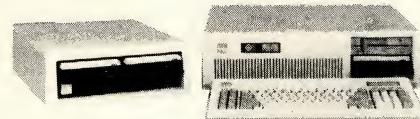
PERSTOR™

Removable Hard Disk Cartridge Expansion Systems

BERNOULLI ALTERNATIVE!

■ High Performance Fixed and Removable from 10 to 560 mbyte

■ Internal or external mount



■ The only Removable Hard Disk Cartridge Drive that attaches directly to the IBM PC-AT Controller*—internally mounted

PERSTOR products provide portability, storage and backup for IBM-PC, AT, XT and compatibles.

DOS, Xenix, Multi-User and Networks

Dual removables 12MB/12MB external \$2,350.00

SYSTEMS & SOFTWARE, INC. (602) 948-7313
7825 East Redfield Road, Scottsdale, AZ 85260

*Patent Pending Copyright 1985 Perstor® is a trademark of Systems and Software, Inc. IBM-PC, AT, XT, are registered trademarks of International Business Machines Corp.

CIRCLE NO. 252 ON READER SERVICE CARD

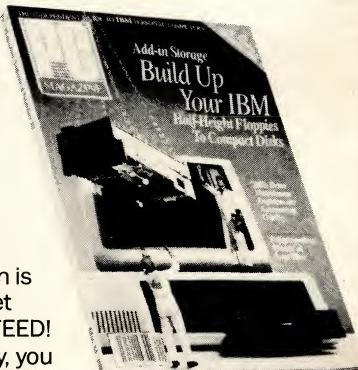
PC GUARANTEES FACTS!

You always get up-to-the-minute news on IBM's fast-paced technology because **PC Magazine** is published 22 times a year. When a new product or application is introduced—you'll get the facts—GUARANTEED!

More importantly, you receive detailed reviews on all new IBM and compatible hardware and software, and tutorials that help you use them effectively.

Discover proven, hands-on applications and innovative ideas directed toward professionals in PC's "ProColumns." Share your PC insights with other users in "User to User." And, get help on specific computing problems in "PC Tutor."

Order **PC Magazine** today, (22 issues) for only \$21.97! Save 66% off the single copy price of \$2.95!



**CALL TOLL FREE
1-800-852-5200!**

Basic one-year subscription rate is \$34.97

8Z801

SWEEPSTAKES

SWEEPSTAKES

SWEEPSTAKES

OFFICIAL ENTRY FORM



YES!

Enter my name in the *PC AT* Sweepstakes
and start my subscription to *PC Magazine* for 22 issues
for \$21.97—a savings of 37% off the regular subscrip-
tion price.



NO, I don't want to subscribe now, but enter
me in the *PC AT* Sweepstakes.

Name _____

PC 8HL77

Company _____

Address _____

City _____ State _____ Zip _____

Payment enclosed Bill me later

Please allow up to 60 days for delivery of first issue. Offer good in U.S. only.





NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL

FIRST CLASS PERMIT #66 BOULDER, COLORADO

POSTAGE WILL BE PAID BY ADDRESSEE



SWEEPSTAKES

P.O. Box 2442
Boulder, Colorado 80321

PB SWEEPSTAKES **PB SWEEPSTAKES** **PB SWEEPSTAKES**

WIN A NEW IBM PC AT!

Here's your ticket to win the powerful and flexible PC AT with 256K RAM, RGB Color Monitor, and Color Graphics Adaptor—WORTH \$5,000! Just complete the Entry Form and mail it today!

TO INCREASE THE POWER AND SCOPE OF YOUR PC—
Subscribe to **PC Magazine**,
The Independent Guide to
IBM Personal Computers.

There's no IBM-specific magazine as targeted to the special needs of business and professional users as **PC Magazine**. Published every two weeks, each issue is packed with up-to-the-minute IBM news, helpful tutorials, in-depth and unbiased product reviews, evaluations and comparisons, PLUS informative features that help you make your IBM PC or compatible a more powerful business tool!

Subscribe today!

OFFICIAL RULES

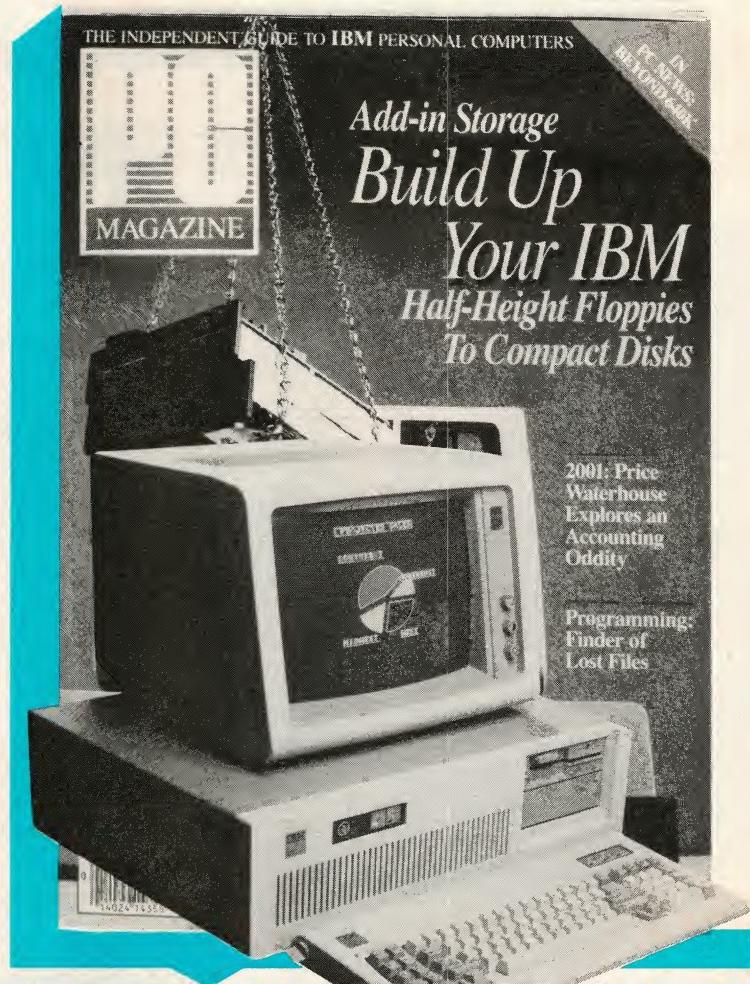
NO PURCHASE NECESSARY

1. On an Official Entry Form or a 3" x 5" piece of paper, hand-print your name, address and zip code. Enter as often as you wish, but mail each entry separately to **PC AT SWEEPSTAKES**, P.O. Box 2442, Boulder, Colorado 80322. Entries must be received no later than June 30, 1986 and the drawing will be held by July 31, 1986. All entries become the property of **PC Magazine** which reserves the right to reprint the name and address of the winner.

2. Winners will be selected in a random drawing from among all entries received. The Ziff-Davis Publishing Company will offer this Sweepstakes within its affiliated magazines and other products and services, including **PC**, **PC Tech Journal** and **Unique Homes**, and guarantee that all prizes will be awarded. The Sweepstakes will be promoted under the names of the **PC AT Sweepstakes** and the **Unique Homes PC AT Sweepstakes**.

3. Sweepstakes open to all residents of the U.S., its territories and possessions, except employees (and their families) of Ziff-Davis Publishing Company, its affiliates, and its advertising and promotion agencies. Void wherever prohibited or restricted by law.

4. For winner's name, send a stamped self-addressed envelope to **PC AT Sweepstakes**, Circulation Department, One Park Avenue, New York, N.Y. 10016.



PB SWEEPSTAKES

P.O. Box 2442
Boulder, Colorado 80322

OFFICIAL ENTRY FORM

YES! Enter my name in the **PC AT Sweepstakes** and start my subscription to **PC Magazine** for 22 issues for only \$21.97—a savings of 37% off the regular subscription price.

NO, I don't want to subscribe now, but enter me in the **PC AT Sweepstakes**.

Name _____

Company _____

Address _____

City _____ State _____ Zip _____

Payment enclosed Bill me later

Please allow up to 60 days for delivery of first issue. Offer good in U.S. only.

C O M P A N Y M I S S I O N

His company sent him on a mission to make two offices 1800 miles apart, work like one.



Every company has a PC expert like him—responsible for directing microcomputing strategies and budgets. His product recommendations are as good as purchase orders.

Where his mission begins

When he's on a tough assignment, he turns to PC Tech Journal first. Because it gives him the advanced technical information he needs, written by micro experts he can trust.

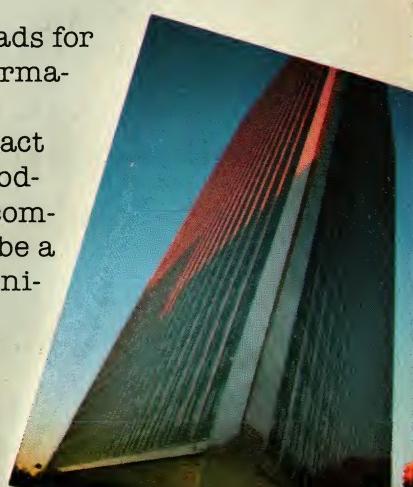
Inside two recent issues, he finds clues to his company's communication problem: Augie Hansen's review of the new communications package, "Relay"—and a preview of David Schwaderer's long awaited book, "Digital Communications Programming for the IBM PC."

Help him face the challenge

It's not only articles he reads for clues. He explores the information he finds in ads, too.

Ads in PC Tech Journal act as signposts to indicate products that can help him accomplish his task (whether it be a problem involving communications, custom boards, mass storage, or operating systems).

And PC experts find your ad without a lot of digging around. Because every product advertised is listed under its proper category in the product index—just one more reason why sophisticated



CASE 1 COMMUNICATIONS



micro experts turn to PC Tech Journal when they're ready to buy.

Accomplish your mission

Don't be the missing clue that can solve this PC expert's problem—and 75,000 other advanced micro experts like him who read PC Tech Journal.

Call your PC Tech Journal sales representative, right now, and let Tech Journal guide customers to where you want them to go—right to your products.



INDEX TO ADVERTISERS

PC TECH JOURNAL MARCH 1986

READER SERVICE NUMBER	ADVERTISER	PAGE	READER SERVICE NUMBER	ADVERTISER	PAGE	READER SERVICE NUMBER	ADVERTISER	PAGE
116	Advanced Logic Research, Inc.	45	149	IBEX Computer Corp.	195	147	Quadram Corp.	90
104	Advanced Logic Research, Inc.	Cover 3	159	Integrated Micro Technology	190	154	Quadram Corp.	114
109	Aldebaran Laboratories, Inc.	139	216	Intel Corp.	62-63	*	Quaid Software Limited	102
231	Alloy Computer Products, Inc.	82	209	Interactive Microwave, Inc.	206	239	Quantum Software Systems, Inc.	148
233	Alloy Computer Products, Inc.	56	117	Intercontinental Micro Systems	130	177	Qua Tech, Inc.	172
101	Alpha Computer Service	151	135	Interface Group, Inc.	181	157	Rainbow Technology	206
200	Alsys, Inc.	159	146	K Software House	190	181	Rational Systems, Inc.	146
198	Ansa Software	38-39	178	Kemp-Carraway Heart Institute	177	165	Real Time Devices, Inc.	182
136	Arity Corporation	153	132	Key Products	174	226	Relational Database Systems, Inc.	164
206	Array Technologies, Inc.	162	128	Lahey Computer Systems, Inc.	122	173	Renex Corp.	88
235	Ashton-Tate Publishing Group	16	160	Lattice, Inc.	127	174	Ryan-McFarland	95
134	Ashton-Tate Publishing Group	58	229	LOGITECH, Inc.	103	228	Schuller & Associates	195
203	Atron	10	172	mbp Software & Systems Technology	152	187	Scientific Endeavors	206
249	Atron	101	153	MGlobal	165	124	Seattle Telecom & Data, Inc.	104
218	Attachmate Corp.	137	208	Manx Software Systems	37	164	SofCap Inc.	196
114	Blaise Computing, Inc.	131	139	Meridian Technology	109	214	Soft Advances	196
250	Borland International	13	138	Merrill Street Software	185	201	SoftCraft	2
247	Bourbaki, Inc.	156	184	Microcomputer Concepts, Inc.	177	246	Software Channels, Inc.	125
*	C Ware Corporation	118	141	Micro Data Base Systems, Inc.	160	143	Software Link, Inc.	70
111	Catamount Corp.	195	207	Micro Data Base Systems, Inc.	107	192	Software Bottling Co. of NY	19
156	Cauzin Systems, Inc.	8-9	120	Micro Data Base Systems, Inc.	33	182	Software Commodities and Futures	215
121	Central Point Software, Inc.	136	211	Micro Data Base Systems, Inc.	216	127	Software of the Future, Inc.	154
122	Chalcedony Software	124	*	Microsoft Corp.	28	168	Software Masters	180
106	Classic Technology Corp.	52	*	Microsoft Corp.	47	123	Solution Systems	14
227	Command Technology Corp.	117	213	Micro-Software Developers, Inc.	174	130	Solution Systems	197
245	Communications Research Group	172	167	Microstuf	Cover 4	126	Solution Systems	21
103	Cordata Inc., formerly Corona Data Systems	26-27	*	Microtec Research	106	129	Solution Systems	21
179	CORE International	116	125	Mix Software	133	190	Speedware	196
112	Cosmos, Inc.	96	161	National Memory Systems Corp.	120	242	Spruce Technology Corp.	196
107	Creative Programming	197	243	NightOwl Software, Inc.	208	183	Sterling Castle	150
118	Data Access Corp.	126	166	Novell, Inc.	6-7	195	Summit Software Technology, Inc.	135
215	Data Base Decisions	5	150	Oasys, Inc.	184	196	Summit Software Technology, Inc.	176
212	Earth Computers	138	222	Opt-Tech Data Processing	4	152	Sunny Hill Software	158
131	Ecosoft, Inc.	170	185	Overland Data, Inc.	182	252	Systems & Software	208
170	Ellis Computing, Inc.	167	171	PC Brand	84-85	186	3-Com	74-75
158	Entelekon	105	241	PC Technologies, Inc.	72	237	TLM Systems	119
140	Essential Software, Inc.	194	145	PC's Limited	64	236	TLM Systems	121
133	Everest Solutions, Inc.	Cover 2	230	Paradise Systems, Inc.	40, 41	238	TLM Systems	123
119	FairCom	120	180	Pecan Software Systems, Inc.	99	197	Tall Tree Systems	173
217	Fifth Generation Systems	167	*	Peter Norton	149	240	Tech PC	22
163	Floppy Disk Services	108	169	Phoenix Computer Products Corp.	112	225	Tecmar	20
108	Foresight Resources Corp.	76-77	205	Phoenix Computer Products Corp.	175	191	Thesys Memory Products Corp.	178
204	Gazelle Systems	187	219	Productivity Products International	168	182	Tiara Computer Systems, Inc.	155
223	Genesis Microsystems	191	176	Programmer's Connection	24-25	193	TurboPower Software	147
*	Gimpel Software	98	175	Programmer's Connection	23	199	UniPress Software	97
105	Greenleaf Software, Inc.	166	220	Programmer's Shop	42	194	VM Personal Computing	17
110	Guaranteed Software	171	151	Programmer's Shop	140-141	115	Vermont Creative Software	92-93
113	HavenTree Software Limited	18	142	Programming Concepts, Inc.	149	221	Wizard Systems Software, Inc.	206
155	Hayes Microcomputer Products, Inc.	68				102	WordTech Systems	188
144	Heuristic Computer Systems	195				148	Zanthe Information, Inc.	1
210	Houston Instruments	100				224	Zedcor, Inc.	183
202	I-Bus Systems	128						
248	IBM Corp.	110-111						

INDEX TO PRODUCTS

PC TECH JOURNAL MARCH 1986

RS#	PRODUCT	ADVERTISER	PAGE	RS#	PRODUCT	ADVERTISER	PAGE	
IBM COMPUTERS AND COMPATIBLE UNITS								
104	ALR System	286	Advanced Logic Research	Cover 3	126	PROLOG-86	Solution Systems	21
116	ALR XT and AT		Advanced Logic Research	45	129	LISP-86	Solution Systems	21
202	PC Bus		I-Bus Systems	128	195	Better BASIC	Summit Software	135
248	IBM PC/AT		IBM Corp.	110-111	196	Better BASIC	Summit Software	176
145	PC's Limited AT		PC's Limited	64	221	Wizard C-Compiler	Wizard Systems Software, Inc.	206
240	TECH Turbo PC, XT, AT		Tech-Personal Computers	22	224	Z Basic	Zedcor, Inc.	183
240	Tech PC, XT, AT		Tech-Personal Computers	22				
145	Turbo PC		PC's Limited	64				
161	PC AT Applications		National Memory Systems, Corp.	120				
ACCESSORY CARDS								
206	Graphics Solutions		Array Technologies, Inc.	162	109	Source Print Utility	Aldebaran Laboratories, Inc.	139
212	Turbo ACCEL 286		Earth Computers	138	200	The PC-AT Compiler	Alys, Inc.	159
216	Above Board		Intel Corp.	62-63	203	PC PROBE	Atron	10
150	The Oasys DS-32		Oasys Inc.	184	249	Software Source	Atron	101
230	Modular Graphics Card		Paradise Systems, Inc.	40-41	114	Programming Tools	Blaise Computing, Inc.	131
241	The 286 Express Card		PC Technologies, Inc.	72	227	SPF/PC Editor	Command Technology Corp.	117
169	Pfaster		Phoenix Computer Products Corp.	112	107	Vitamin C	Creative Programming Cons.	197
147	QuadSprint		Quadram Corp.	90	215	Periscope	Data Base Decisions	5
154	Quadboard-AT		Quadram Corp.	114	158	C Library, C Windows	Entelekon	105
165	GPIO Interface		Real Time Devices, Inc.	182	140	C Utility Library	Essential Software, Inc.	194
124	Top Board		Seattle Telecom & Data	104	133	H.E.L.P.	Everest Solutions, Inc.	Cover 2
197	JLaser		Tall Tree Systems	173	119	C-Tree	FairCom	120
191	Fastcard IV		Thesys Memory Products Corp.	178	223	GeneLink	Genesis Microsystems	191
236	Z80H Bluestreak		TLM Systems	121	105	C Library/Greenleaf Functions	Greenleaf Software	166
238	68000/68010/68020 Coprocessor		TLM Systems	123	144	HCS/Editor	Heuristic Computer Systems	195
212	Turbo Slave PC		Earth Computers	138	159	Window Weaver	Integrated Micro Technology	190
177	Data Acquisition		Qua Tech, Inc.	172	178	FLOPS	Kemp-Carraway Heart Institute	177
173	DATAHAWK		Renex Corp.	88	132	SWCost	Key Products	174
MASS STORAGE HARDWARE								
231	Streamliner Series		Alloy Computer Products	82	213	MSD C Debugger	Micro-Software Developers, Inc.	174
111	9 Track Tape System		Catamount Corp.	195	*	C Cross Compiler	Microtec Research	106
179	GIGAfile File-Stretcher		CORE International	116	125	Mix Editor/CCompiler	Mix Software	133
149	TS-100 for IBM PC/XT		IBEX Computer Corp.	195	222	Productivity Tools	Opt-Tech Data Processing	5
209	Data Aquisition Card		Interactive Microware	206	171	Various	PC Brand	84-85
161	Multibus Systems		National Memory Systems, Corp.	120	*	Norton Editor	Peter Norton Utilities	149
185	TC-PC and TC-50		Overland Data, Inc.	182	205	Pfix 86 Plus	Phoenix Computer Products Corp.	175
252	Perstor		Systems & Software, Inc.	208	214	DSD-86	Soft Advances	196
237	VCR Backup		TLM Systems	119	201	Btrieve	SoftCraft	2
161	Digital Equipment-Microwax		National Memory Systems, Corp.	120	168	The Visible Computer	Software Masters	180
PRINTERS-PLOTTERS								
103	Cordata Laser Printer		Cordata, Inc., formerly Corona Data Systems	26-27	127	Window DOS	Software of the Future, Inc.	154
210	41/42 Plotter		Houston Instruments	100	123	BRIEF	Solution Systems	14
ALTERNATE INPUT DEVICES								
156	Softstrip System		Cauzin Systems, Inc.	8-9	190	Turbo Editasm	Speedware	196
INTEGRATED CIRCUITS								
141	MC Format		Microcomputer Concepts, Inc.	177	242	Firsttime	Spruce Technology	196
SECURITY DEVICES								
157	Sentinel		Rainbow Technologies	206	183	Basic Prog. Tools	Sterling Castle	150
COMMUNICATIONS HARDWARE								
218	3-N-1 Coax Adaptor		Attachmate Corp.	137	152	Taskmaster	Sunny Hill Software	158
155	Transet 1000		Hayes Microcomputer Products, Inc.	68	192	Flashcode, Screen Sculptor, Window Sculptor	The Software Bottling Co. of NY	19
COMMUNICATIONS								
245	BLAST		Communications Research Group	172	193	Turbo Extender	Turbo Power Software	147
139	Carbon Copy Transporter		Meridian Technology	109	199	EMACS MS-DOS	UniPress Software	97
167	MEX-PC		Microstuf	Cover 4	115	Windows For Data	Vermont Creative Software	92
243	SFT Netware		NightOwl Software	208	115	Windows for C	Vermont Creative Software	93
130	ZAP		Novell, Inc.	6-7	102	WordTech Compiler	WordTech Systems, Inc.	188
225	5251 Emulator		Solution Systems	197				
194	RELAY Gold		Tecmar, Inc.	20				
			VM Personal Computing	17				
SOFTWARE FOR PROFESSIONALS								
101	The Statistician		Alpha Computer Service	151				
ENGINEERING SOFTWARE								
142	C-LIST		Programming Concepts, Inc.	149				
108	Drafix		Foresight Resources Corp.	76-77				
LANGUAGES								
136	Arity Prolog Compiler		Arity Corporation	153	198	Paradox	Bourbaki, Inc.	156
250	Pascal Family		Borland International	13	112	Revelation	Central Point Software	136
*	DeMet C		C Ware	118	118	DataFlex	Fifth Generation Systems	167
122	Prolog Interpreter		Chalcedony Software	124	120	Q-DOS	Gazelle Systems	187
131	'Ecosoft' C		Ecosoft, Inc.	170	110	ARKIVE	Guaranteed Software	171
170	UTAH Software		Ellis Computing	167	146	Scientific Calculator	K Software House	190
*	C-Terp		Gimpel Software	98	138	SuperBatch	Merrill Street Software	185
128	F77L Fortran Compiler		Lahey Computer Systems	122	228	CopyWrite	Quaid Software	102
160	C-Compiler		Lattice, Inc.	127	164	file Master	Schuller & Associates	195
229	Modular 2		LOGITECH, Inc.	103	101	HD Tune-Up	SofCap Inc.	196
172	mbp COBOL		mbp Software & Sys. Tech, Inc.	152		The Statistician	Alpha Computer Service	151
153	CCSM		MGlobal	167				
208	Aztec C86		Manx Software Systems	37				
*	Quick BASIC		Microsoft Corp.	47				
180	UCSD Pascal		Pecan Software Systems, Inc.	99				
219	Objective C		Productivity Products, Inc.	168				
181	Instant C		Rational Systems	146				
174	RM/Fortran		Ryan-McFarland	95				
246	Alice/Personal Pascal		Software Channels, Inc.	125				
PROGRAMMER'S TOOLS								
109	Source Print Utility							
200	The PC-AT Compiler							
203	PC PROBE							
249	Software Source							
114	Programming Tools							
227	SPF/PC Editor							
107	Vitamin C							
215	Periscope							
158	C Library, C Windows							
140	C Utility Library							
133	H.E.L.P.							
119	C-Tree							
223	GeneLink							
105	C Library/Greenleaf Functions							
144	HCS/Editor							
159	Window Weaver							
178	FLOPS							
132	SWCost							
213	MSD C Debugger							
*	C Cross Compiler							
125	Mix Editor/CCompiler							
222	Productivity Tools							
171	Various							
*	Norton Editor							
205	Pfix 86 Plus							
214	DSD-86							
201	Btrieve							
168	The Visible Computer							
127	Window DOS							
123	BRIEF							
190	Turbo Editasm							
242	Firstime							
183	Basic Prog. Tools							
152	Taskmaster							
192	Flashcode, Screen Sculptor, Window Sculptor							
193	Turbo Extender							
199	EMACS MS-DOS							
115	Windows For Data							
115	Windows for C							
102	WordTech Compiler							
SOFTWARE UTILITIES								
247	1dir							
121	PC TOOLS							
217	Fastback							
204	Q-DOS							
110	ARKIVE							
146	Scientific Calculator							
138	SuperBatch							
*	CopyWrite							
228	file Master							
164	HD Tune-Up							
101	The Statistician							
GRAPHICS SOFTWARE								
108	Drafix 1							
113	Flowchart							
187	Graphic C							
DATA BASE MANAGEMENT SOFTWARE								
198	Paradox							
112	Revelation							
118	DataFlex							
120	MDBS III							
211	Knowledge Man 2							
226	INFORMIX-4GL							
148	ZIM							
141	Guru							
177	QNX							
OPERATING SYSTEMS								
171	ONE STOP LAN Solutions							
106	LAN Power							
117	Multilink Advanced							
143	Tiara Link							
182								
NETWORKING PRODUCTS								
186	3 Plus							
233	PC Slave							
106	286 Speed Pack							
117	Alloy Computer Products, Inc.							
207	Classic Technology Corp.							
143	Intercontinental Micro Systems							
182	Micro Data Base Systems, Inc.							
182	Relational Data Base Systems, Inc.							
148	Zanthe Information, Inc.							
ARTIFICIAL INTELLIGENCE								
141	Artificial Intelligence							
171	QNX							
LIITERATURE								
235	Ashton-Tate Pubs.							
134	Ashton-Tate Pubs.							
*	Newsletter							
MAIL ORDER								
163	Mail Order							
175	Mail Order							
106	Mail Order							
118	Mail Order							
146	Mail Order							



I didn't know it was a crime

They told me those copies of programs I made for my computer could cost the company hundreds of thousands of dollars. Maybe even cost me my job.

Few people realize that software piracy is a Federal crime. At ADAPSO, the computer software and services industry association, we're doing everything we can to inform the public of the problem. And the penalties.

You could unknowingly put your company on the receiving end of a lawsuit by making illegal copies of software. Maybe even put yourself on the receiving end of a pink slip. And that's why ADAPSO wants you to know the facts.

Return the coupon for a brochure that explains the risks of software piracy. It's free. And it may help you keep your job.

Send this coupon or your business card for more information.
Or call us at (703) 522-5055 and ask for Marilyn.

ADAPSO, 1300 North Seventeenth Street, Arlington,
Virginia 22209

NAME _____ TITLE _____

COMPANY _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____



Software Piracy is a Federal Crime

AVOCET

GREENLEAF

MARK WILLIAMS

RAIMA

PHOENIX

DATA BASE DECISIONS

LUGARU

DATABASES

BTRIEVE-softcraft
 B-trees-softfocus
 C-tree-faircom
 C to Dbase-computer innovations
 dBC-lattice
 db_Vista-raima
 Phact-unipress
 Q Pro 4-quic-n-easi

SAVE \$\$\$\$\$

UTILITIES

BLAISE TOOLS-entire line
 C utility Library-essential
 C Power Packs-software horizons
 Cterp-gimpel
GREENLEAF-greenleaf
 Hammer "C"-o.e.s. systems
 Isac- akron software
 Pre-C-phoenix
POLYTRON TOOLS-entire line
 Realform-realia facility
 Screenio-realia facility
 Screen Sculptor-software bottling
 Turbo Power Tools-turbo power
 Windows for "C"-creative solutions

MISCELLANEOUS

C-Sprite-lattice
 H.E.L.P.-everest solutions
 HS/FORTH-harvard software
 Living "C"-living software
 Modula2-interface technologies
 Opt Tech Soft- opt tech data
PANEL-roundhill
 PC Lint-gimpel
 Pfinish-phoenix
 Plink 86-phoenix
 Pmaker-phoenix
Topview Toolbox-lattice
 Vitamin "C"- creative programming
 XENIX - CALL

DEBUGGERS

Advanced Trace-morgan computing
ATRON DEBUGGERS-entire line
 CI Probe- computer innovations
 Cdebugger-msd
 Codesmith 86-visual age
 Periscope-data base decisions
 Pfix 86- phoenix

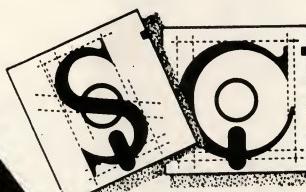
NEW PRODUCTS!

800-268-9799

U.S. & CANADA

ARTIFICIAL INTELLIGENCE

Arity/Prolog-arity
 Byso lisp-levien
 GC LISP-gold hill
 IQ Lisp-integral quality
Micro Prolog-logic programming
 Mprolog-logicware
PROLOG 86-solution systems
 Waltz LISP-procode international



ATTENTION DEVELOPERS

C LANGUAGE

CI C86-computer innovations
 Instant C- rational systems
 Introducing "C"-computer innovations
Lattice C-lattice
 Lets "C"-mark williams
 MWC-mark williams
 Microsoft C vers. 3.0

AMEX*MASTERCARD*VISA
 CORPORATE P.O.'S ACCEPTED

CALL FOR PRICES

800-268-9799

U.S. & CANADA

(IN TORONTO 416-865-1600)

VOLUME DISCOUNTS!!!

LANGUAGES

APL*PLUS/PC-stsc
 Avocet CROSS ASSEMBLERS
 Basic_C-c source
 Better Basic-summit software
 Fortran 77-digital research
 MS fortran-microsoft
MS MACRO-microsoft
 MS pascal-microsoft
 MS cobol-microsoft
 mpb Cobol-mpb
 Pocket APL-stsc
 Porta APL-portable software
REALIA COBOL-realia
 Ryan McFarland-cobol/fortran
Turbo Pascal-borland

LIBRARIES

BASTOC-jmi consultants
 C Helper-solution systems
 Csharp-systems guild
 Faster C-solution systems
 lattice window-lattice
 LMK-lattice
Rom PACK-computer Innovations
 Scrio-delta health systems

SAVE \$\$\$\$\$

EDITORS

Brief-solution systems
C Screen Editor-solution systems
 EMACS-unipress
Epsilon-lugaru
 ESP/C-bellsoft
 Firstime- spruce technology
 Kedit-mansfield
Pmate-phoenix
 SPF/PC-command technology
 Vedit Plus-compuview
 XTC-wendin

GRAPHICS

CDI sound-graphic software
 GraphiC-scientific endeavors
 Graphmatic-microcompatibles
 GSS-Drivers-graphic software
 Metawindow-metographics
Multihalo-media cybernetics
 Statgraphics-stsc

SOFTCRAFT

COMPUTER INNOVATIONS

POLYTRON

ATRON

LATTICE

ROUNDHILL

GIMPEL

BLAISE

CIRCLE NO. 189 ON READER SERVICE CARD

SOFTWARE COMMODITIES & FUTURES INTERNATIONAL
 334 KING STREET EAST - TORONTO ONTARIO M5A 1K8
 800-268-9799/416-865-1600/TELEX 06-983639



LETS YOU GET TODAY'S WORK DONE ... AND PLAN FOR TOMORROW



KnowledgeMan/2, the most advanced business software available, lets you be more productive than ever before and in less time. These powerful business capabilities, tightly fused into a single program, work together for you:

- Relational data management
- Spur-of-the-moment inquiry
- Spreadsheets
- Statistical analysis
- Forms management
- Programming language
- Options for creating graphs, processing text, generating reports, painting forms, mouse processing and remote communications.

KnowledgeMan/2's four user interfaces make it easy for you... and all your business people... to work with KnowledgeMan/2:

- Menus, help screens and easy-to-use documentation guide your every step, if you're just beginning.
- Direct commands for the power user, with help available when you want it.
- K-Chat, the optional natural language interface, for asking for information in plain English.
- Procedural programming for the advanced user.

Get KnowledgeMan/2 working for you today. And start planning for tomorrow.

KnowledgeMan/2 is available for IBM PC, XT, AT and compatibles with PCDOS, 16-bit micros with MSDOS or CP/M-86. Special versions are available for UNIX multi-user operating systems and IBM, 3Com and Novell Local Area Networks (LANs).

For the name of the KnowledgeMan/2 dealer near you, call or write Micro Data Base Systems, Inc./Marketing & Sales, P.O. Box 248, Lafayette, IN 47902. 317/463-2581, Telex 209147 ISE UR.



Use these reader service cards to get FREE INFORMATION about the products and services in this issue of TECH JOURNAL

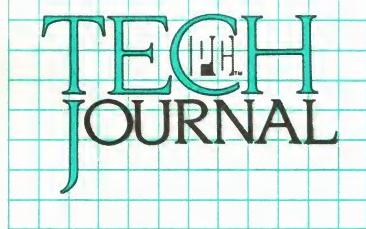
Learning more about a product that's advertised or mentioned in an article in this month's issue is as simple as 1-2-3. And absolutely free.

1 Print or type your name and address on the attached card.
Use only one card per person.

2 Circle the numbers on the card that correspond to the numbers at the bottom of the advertisements or articles for which you want more information.

(Key numbers for advertised products also appear in the Advertisers' index.)

3 Simply mail the card, and the literature will be mailed to you free of charge by the manufacturer.



1 Do you own an IBM or compatible microcomputer?
 Yes No

Are you personally involved in the selection of microcomputers and related products for:

2 Your company or organization?
 Yes No

3 Your client companies or organizations?
 Yes No

Void after June 30, 1986

101	116	131	146	161	176	191	206	221	236	251	266	281	296	311	326	341	356	371	386
102	117	132	147	162	177	192	207	222	237	252	267	282	297	312	327	342	357	372	387
103	118	133	148	163	178	193	208	223	238	253	268	283	298	313	328	343	358	373	388
104	119	134	149	164	179	194	209	224	239	254	269	284	299	314	329	344	359	374	389
105	120	135	150	165	180	195	210	225	240	255	270	285	300	315	330	345	360	375	390
106	121	136	151	166	181	196	211	226	241	256	271	286	301	316	331	346	361	376	391
107	122	137	152	167	182	197	212	227	242	257	272	287	302	317	332	347	362	377	392
108	123	138	153	168	183	198	213	228	243	258	273	288	303	318	333	348	363	378	393
109	124	139	154	169	184	199	214	229	244	259	274	289	304	319	334	349	364	379	394
110	125	140	155	170	185	200	215	230	245	260	275	290	305	320	335	350	365	380	395
111	126	141	156	171	186	201	216	231	246	261	276	291	306	321	336	351	366	381	396
112	127	142	157	172	187	202	217	232	247	262	277	292	307	322	337	352	367	382	397
113	128	143	158	173	188	203	218	233	248	263	278	293	308	323	338	353	368	383	398
114	129	144	159	174	189	204	219	234	249	264	279	294	309	324	339	354	369	384	399
115	130	145	160	175	190	205	220	235	250	265	280	295	310	325	340	355	370	385	400

Please print clearly—Use only one card per person.

Name _____ Phone () _____
 Company _____ Title _____
 Address _____ Apt. _____
 City _____ State _____ Zip _____
 (Zip code must be included to insure delivery.)

Please send me 1 year (12 issues) of PC Tech Journal for \$23.70 and bill me.
 I'll save 50% off the single copy price!

TJ3862

Void after June 30, 1986

101	116	131	146	161	176	191	206	221	236	251	266	281	296	311	326	341	356	371	386
102	117	132	147	162	177	192	207	222	237	252	267	282	297	312	327	342	357	372	387
103	118	133	148	163	178	193	208	223	238	253	268	283	298	313	328	343	358	373	388
104	119	134	149	164	179	194	209	224	239	254	269	284	299	314	329	344	359	374	389
105	120	135	150	165	180	195	210	225	240	255	270	285	300	315	330	345	360	375	390
106	121	136	151	166	181	196	211	226	241	256	271	286	301	316	331	346	361	376	391
107	122	137	152	167	182	197	212	227	242	257	272	287	302	317	332	347	362	377	392
108	123	138	153	168	183	198	213	228	243	258	273	288	303	318	333	348	363	378	393
109	124	139	154	169	184	199	214	229	244	259	274	289	304	319	334	349	364	379	394
110	125	140	155	170	185	200	215	230	245	260	275	290	305	320	335	350	365	380	395
111	126	141	156	171	186	201	216	231	246	261	276	291	306	321	336	351	366	381	396
112	127	142	157	172	187	202	217	232	247	262	277	292	307	322	337	352	367	382	397
113	128	143	158	173	188	203	218	233	248	263	278	293	308	323	338	353	368	383	398
114	129	144	159	174	189	204	219	234	249	264	279	294	309	324	339	354	369	384	399
115	130	145	160	175	190	205	220	235	250	265	280	295	310	325	340	355	370	385	400

Please print clearly—Use only one card per person.

Name _____ Phone () _____
 Company _____ Title _____
 Address _____ Apt. _____
 City _____ State _____ Zip _____
 (Zip code must be included to insure delivery.)

Please send me 1 year (12 issues) of PC Tech Journal for \$23.70 and bill me.
 I'll save 50% off the single copy price!

TJ3861

FREE INFORMATION

Follow the instructions
on the reverse side of
this card to
receive advertisers'
product information.
FREE.

SUBSCRIBE NOW!

Now's an ideal time to
consider having us start
you as a PC Tech Jour-
nal subscriber.
12 issues cost you
only \$23.70...a savings
of 50% off the single
copy price. Just check
the box at the bottom
of the reply card.



NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL

FIRST CLASS PERMIT NO. 27346 PHILADELPHIA, PA

Postage will be paid by addressee

**TECH
JOURNAL**
P.O. Box 40086
Philadelphia, PA 19106-9931



NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL

FIRST CLASS PERMIT NO. 27346 PHILADELPHIA, PA

Postage will be paid by addressee

**TECH
JOURNAL**
P.O. Box 40086
Philadelphia, PA 19106-9931



BUSINESS SYSTEM 286

33% Faster than IBM's Powerful PC AT

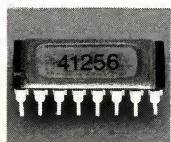
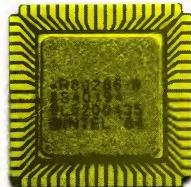
**SYSTEM 286
STARTING AT
\$1995.00**



THE ALR SYSTEM 286

The ALR System 286 is based on the advanced 80286-8 16 bit microprocessor with a system clock rate of 8MHz. This performance results in running most IBM® PC or XT software up to 350 % faster. In seconds you'll be able to recalculate large spreadsheets and instantly load files.

Compatibility by Design. At Advanced Logic Research, the System 286 was designed to be 100 % IBM PC AT bus compatible with full attention paid to the BIOS ROMs resulting in total support of IBM DOS 3.0, 3.1 and Xenix™ operating systems.



2MEGA BYTE USER MEMORY

The System 286 CPU Board can be expanded to a full 2 megabytes of parity checked user memory. This saves you valuable expansion slots and reduces your total system cost. With the addition of the award winning ALR Challenger you will be able to expand your total system memory to an incredible 15 megabytes.

WITH FULL DEALER SUPPORT

CONTACT ALR FOR INFORMATION ON A DEALER NEAR YOU!

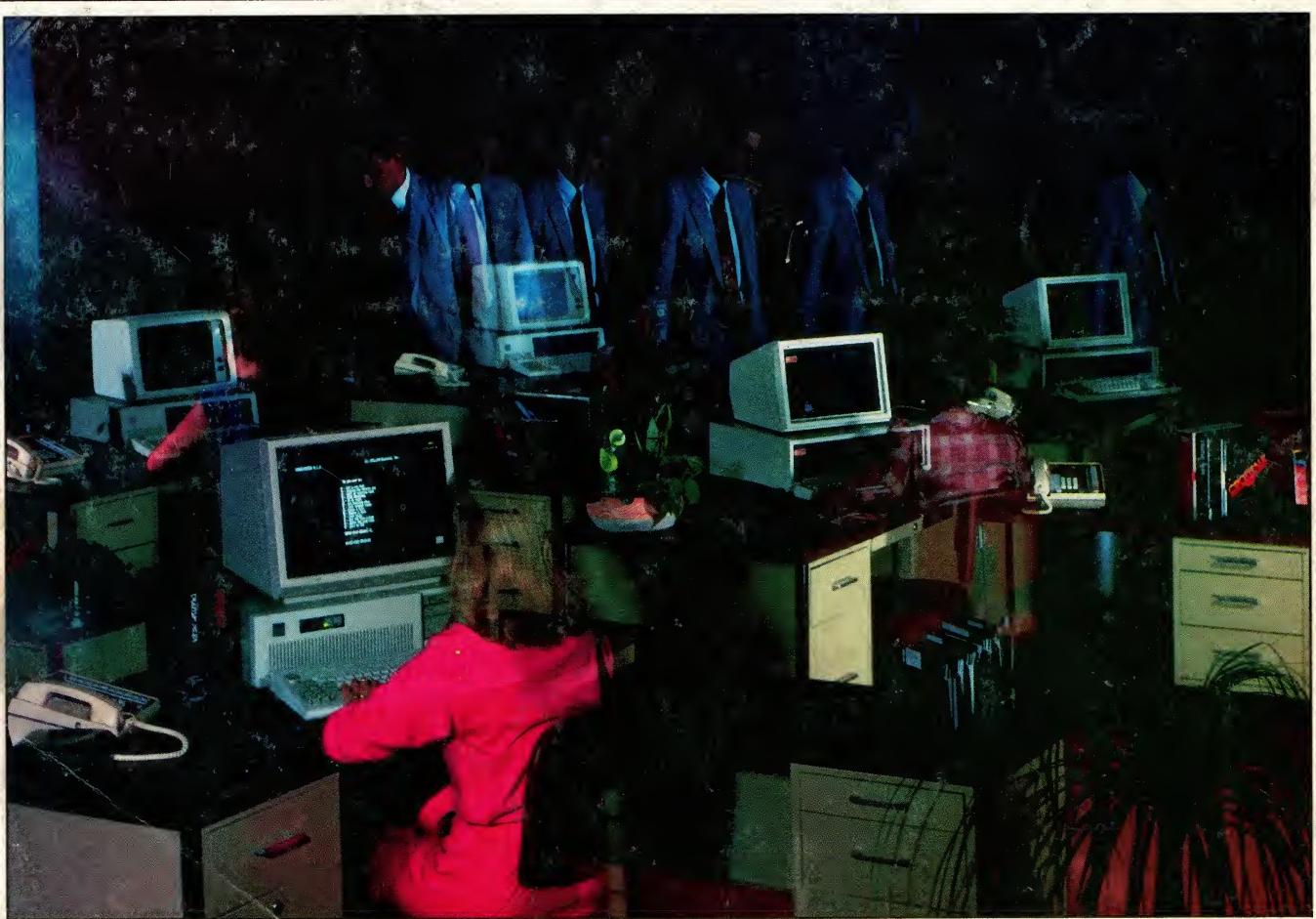


ADVANCED LOGIC RESEARCH, INC.
2991 E. WHITE STAR AVE.
ANAHEIM, CA 92806
(714) 666-2951

XENIX™ is a registered trademark of MicroSoft Corporation
IBM® is a registered trademark of IBM Corporation

CIRCLE NO. 104 ON READER SERVICE CARD

The Transporter Night Shift



Long After Your Staff Goes Home, We Keep Your PC Making Calls, Sending and Receiving Files, and Keeping a Log

Your microcomputer doesn't go home at five. Why not keep it working?

TRANSPORTER keeps your PC communicating almost as well as your staff could do it. Just load it with a "task list" before you go home. It can automatically call other computers, log in, repeat calls if necessary, send and receive files, and more.

It can do it overnight, when phone rates are lowest.

The next morning, TRANSPORTER gives you a report of what it has accomplished during its night shift.

So you can start the day ahead of the game.

TRANSPORTER comes with our popular CROSSTALK data communications program added on. It communicates with any other system running TRANSPORTER or CROSSTALK. For details, see your retailer or write for a brochure.

MICROSTUF[®]

1000 Holcomb Woods Parkway
Roswell, Georgia 30076

For the IBM Personal Computer. Requires 128K RAM, two disk drives, PC-DOS, Asynchronous Communications Interface or equivalent RS232 connection, and a modem compatible with the 'AT' command set.

TRANSPORTERTM

CIRCLE 167 ON READER SERVICE CARD